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To Keep Page Orientation Correct

Instructions for Printing & Binding

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Begin printing on Page 1 (the Cover) and print both sides of paper.

Page orientation is important. This can be seen when you get to Pages 22 & 23 which should be facing you when the Manual is open, as well as many more as you progress through the manual. This has the Narrative and the proper Drawing facing you at the same time.

Print on 20 Lb (Min.) Premium Paper or better, Printing both sides of paper.

I prefer Spiral Bound with Clear Front Cover and Heavy Black Back Cover.
This allows the manual to be opened and folded back leaving the desired page exposed and lays flat when opened to expose 2 pages while doing Inspections or Maintenance.

I generally get them printed at Staples or Office Depot where it costs as little as $15.00 USD per manual in Black & White, printing only the Front Cover (page1) in Color.

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Thank you for your interest in our products! Be Safe & Have Fun!! Ed Pitman

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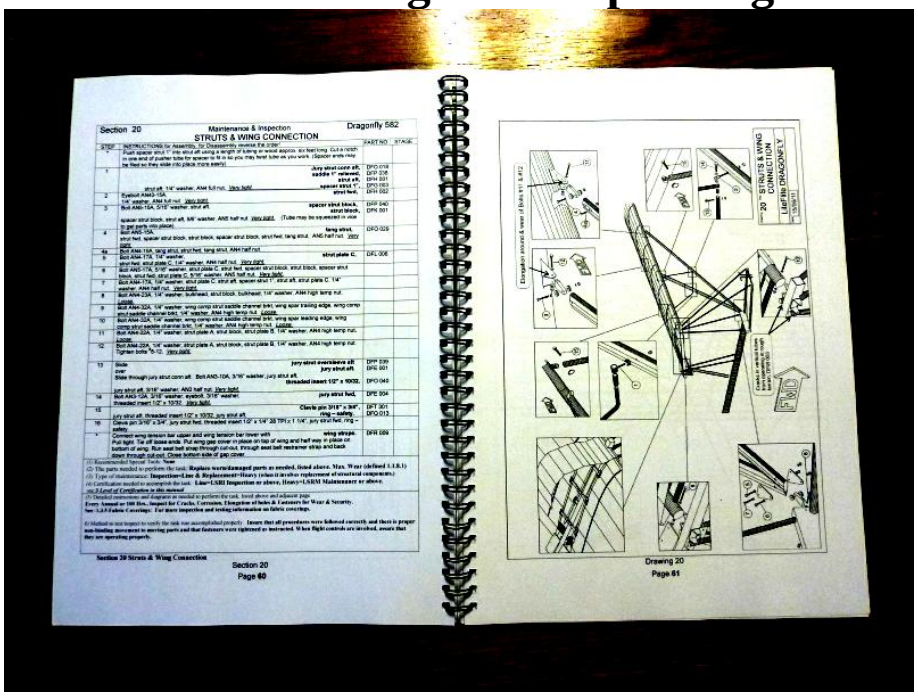

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Bailey Moyes

Dragonfly

By Pitman Air

Pilot's Operating Handbook
& Flight Training Supplement
Light Sport Dragonfly
SLSA 912/582
Kit ELSA 912/582

Airplane Registration Number _____

Airplane Serial Number _____

Date of Delivery _____
dd/mm/yyyy

This Manual only applies to SLSA Dragonfly Aircraft and ELSA Dragonfly Kits manufactured by Pitman Air in the United States of America.

copyright Ed Pitman & Bill Moyes 2013

Record of Manual Revisions

Note* A current version of this manual is always available
on the internet at: http://www.pitmanair.com/dragonfly

# dd/mm/yyyy Revision Number & Date	Headings	Paragraph	Page numbers
Rev. 0 03/04/2013	All	All	All
Rev. 1 01/12/2014	Add Exemption as Appendix E Old E moved to F	All	All

Serial Number Information

PA or PAK -____ _____ _____ - _____ _____ _____

Pitman Air or Pitman Air Kit – Engine – Production Number

Example: PA-582-111

Warning

Limited Aerobatics

The Dragonfly was not designed for many Aerobatic Maneuvers,
Prior authorized maneuvers only with proper training!

Solo Flight from Front Seat Only!

Always Insure that Weight & Balance are within Limits!

Owner/Operator Responsiblities

The Owner/Operator is responsible for Maintaining the Aircraft in accordance with the Inspection and Maintenance Procedures as defined in the Pilot Operating Handbook & Maintenance Manuals.

Safety of Flight and/or Service Difficulties must be Reported as soon as possible, by using a copy of the Form in the POH by Mail or Online at: www.pitmanair.com/dragonfly/sofreportform.htm

The Owner is Responsible for keeping all Current Contact Information on file at Pitman Air. This can be done by Mail or Online at: www.pitmanair.com/dragonfly/contactform.htm

Current versions of all Manuals are at available Online at: www.pitmanair.com/dragonfly/manuals

See Page 26 of this Manual “Owner/Operator Responsibilities” for details.

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Safety of Flight & Service Difficulty Report Form 115

Copy this page to file Safety of Flight or Service Difficulty Report

Safety of Flight & Service Difficulty Report Form

Mail to: Pitman Air, 1840 Airport Blvd., Red Bluff, CA 96080 or Online at: www.pitmanair.com/dragonfly/

Circle One	Item of Concern	Safety of Flight	Service Difficulty

Reporting Party Contact Information

Name	
Address	
City	
ST	
Zip Code	
Day Phone #	
FAX #	
email address	

Check Appropriate

Owner	Operator	LSRI	LSRM	A&P
Other Explain:				

Aircraft Specific Information

Aircraft Information		Engine Information	
Make		Make	
Model		Model	
Serial Number		Serial Number	
N-Number		Gearbox Ratio	
Date of Mfg.		Propeller Mfg	
		Propeller Serial #	

Date of Problem Discovery _____ dd/mm/yyyy

Description:

Use Attachments and Photo's if Needed

Comments _____

Signature_____-Date_____dd/mm/yyyy

Introduction

ASTM standards used

Design & Performance and Required Equipment:	F 2245-11
Quality Assurance and Production Acceptance Tests:	F 2279-06
Continued Operational Safety Monitoring	F 2295-06
Maintenance & Inspection Procedures	F 2483-05
Pilot Operating Handbook (POH)	F 2245-11 & F 2746-09
Terminology for LSA	F 2626-07
Airframe Emergency Parachutes	F 2316-08
Kit Assembly Instructions	F2563-06
Required Product Information	F2745-11

In accordance with 14 CFR part 21.190

America's LSA Manufacturer:
Pitman Air
1840 Airport Blvd.
Red Bluff, CA 96080
Email: ed_pitman@hotmail.com
Ed Pitman 530-945-1860 9 – 5 Pacific Time
Technical support:
Bobby Bailey 352 429 5660 Eastern Time
Rhett Radford 603 690 5200 Eastern Time

Many Airframe Parts Manufacturer:
Lite Flite Pty Ltd.
1144 Botany Road
Botany NSW 2019
Australia
Ph. +61 2 9316 5543
Fax +61 2 9316 8488
Email bill@moyes.com.au

Documentation Recovery:

Contact the Pitman Air business location above or
For N Numbered Aircaft , your documentation can be obtained through the FAA
http://registry.faa.gov/aircraftinquiry/
Look up your craft by N Number and use the (**obtain information**) as shown below

This is the most current Airworthiness Certificate data, however, it may not reflect the current aircraft configuration. For that information, see the aircraft record. A copy can be obtained at http://162.58.35.241/e.gov/ND/airrecordsND.asp

Quality Assurance Monitoring:

Refer to Quality Assurance Manual (QAM)

Current information can be obtained through

www.pitmanair.com/dragonfly
or
www.safetydirectives.com/dragonfly

1 - General Information

1.1 Introduction to airplane.

This Light Sport Aircraft is manufactured to meet the requirements United States of America Light Sport Category.

The pilot's weight range is from 143lbs. (Standard 582) to 187 lbs. (Standard 912) (unless ballast is utilized, see Weight and Balance Section 6 page 20) and this aircraft when flown solo must only be flown from the front seat for weight and balance reasons. The pilot's weight is essential to be in the front seat to keep the aircraft balanced within its Center of Gravity (CG) Range. (Refer to Weight and Balance Section 6, page 20.)

The pilot must have a valid Sport Pilot Certificate or higher with proper endorsements.

This aircraft must be flown and operated within the current FAA Regulations.

The Dragonfly is designed to fly with the Flaperons in permanent partial Flaps on position. The low speed capabilities of this aircraft create a particular set of characteristics and each pilot shall become familiar with its ground handling and flight characteristics before towing or carrying passengers.

This aircraft's engines are not certified aircraft engines. All engines are subject to failure. This should always be considered when choosing a flight path. The path chosen should allow for emergency landings.

Changes to the controls and control surfaces should not be attempted. There is a balance of aerodynamic forces to consider.

1.1 Equipment List:

1.1.1 Required Equipment

1.1.2.1 *Flight and Navigation Instruments*:
1.1.2.1.1 Airspeed indicator, (for markings refer to Section 10.1)

1.1.2.1.2 Altimeter. (in EIS Manual Appendix A of this manual)

1.1.2.2 *Powerplant Instruments*:
1.1.2.2.1 Fuel quantity indicator, (Visual on Tank)
1.1.2.2.2 Tachometer (RPM) (EGT) (CHT), Coolant Temp, Hour Meter (in EIS Manual Appendix A of this manual)
1.1.2.2.3 Engine "kill" switch, Mag 1 & Mag 2 to Off Position (Master Switch OFF will not stop engine)
1.1.2.2.4 Engine instruments as required by the engine manufacturer. (in EIS Manual Appendix A of this manual)
Set EIS Warning Limits to Rotax specifications.

1.1.2.3 *Miscellaneous Equipment*:
1.1.2.3.1 Ballistic Recovery System SECOND CHANTZ 1100# Compressed Air Propelled
1.1.2.3.2 Bailey Release and Tow System (when used for Aero-Towing)

1.1.2.4 *Safety Belts and Harnesses*

1.1.2.5 ELT AMERI-KING ELT AK-450

1.2 Summary of the performance specifications

1.2.1 Gross Weight 1080 lbs / 490 kg

1.2.2 Top speed 582UL 66mph @ 6500 rpm & 912ULS 66 mph @ 5000 rpm
Cruise speed 582UL 54mph @ 5200 rpm & 912ULS 54 mph @ 4300 rpm

1.2.3 Full fuel range

582UL - 50 sm @ 5200rpm., 912UL 78 sm @ 4300 rpm., & 912ULS - 70 sm @ 4300 rpm
(6 Gallon Tank) with 30 min. reserve

1.2.4 Rate of climb

Vx Best Angle-of-Climb	582UL	37 mph ≈ 750 fpm (solo)	44 mph ≈ 350 fpm @ GROSS WEIGHT
	912UL	37 mph ≈ 900 fpm (solo)	44 mph ≈ 500 fpm @ GROSS WEIGHT
	912ULS	37 mph ≈ 1100 fpm (solo)	44 mph ≈ 750 fpm @ GROSS WEIGHT
Vy Best Rate-of-Climb	582UL	42 mph ≈ 850 fpm (solo)	47 mph ≈ 350 fpm @ GROSS WEIGHT
	912UL	42 mph ≈ 1000 fpm (solo)	47 mph ≈ 550 fpm @ GROSS WEIGHT
	912ULS	42 mph ≈ 1200 fpm (solo)	47 mph ≈ 800 fpm @ GROSS WEIGHT

1.2.5 Stall speed
30 - 38 mph

1.2.6 Total fuel capacity
6.1 gallons 5.9 useable

1.2.7 Maximum engine power output
582UL 64hp / 48kW @ 6500 rpm
912UL 80 hp / 59.6 kW @ 5600 rpm Max. Continuous HP.
912ULS 99 hp / 73.5 kW @ 5800 rpm (3 minutes Max.)
90 hp / 69 kW @ 5500 rpm Max. Continuous HP.
Refer to Graphs in Section 2.10

2 -Operating Limitations:

2.1 Airspeed Indicator speed range markings
Falcon Airspeed Indicator ASI (refer to Appendix C)

2.2 Stalling speed at maximum takeoff weight
Vs 38 mph @ GROSS WEIGHT

2.3 Flap extended speed range
N/A No Flaps

2.4 Maneuvering speed V_A
at Gross Weight 55 mph and 60 mph solo

2.5 Never exceed speed V_{NE} 66 mph

2.6 Service Ceiling
15,000 ft.

2.7 Load factors
+4G -2G

2.8 Approved maneuvers Limited Aerobatics **, These Aerobatics shall only be performed Solo, except for training with factory test pilot.

2.8.1 Spins **
2.8.2 Loops **
2.8.3 Rolls **

**** Note: Aerobatic Maneuvers limited to approved maneuvers for the Dragonfly and performed by a Pilot with proper training in the "Dragonfly Aerobatics Course".**
**** Caution: Engine is limited to positive G forces at all times. Engine damage or failure may occur if negative G forces are held for more than a few seconds.**

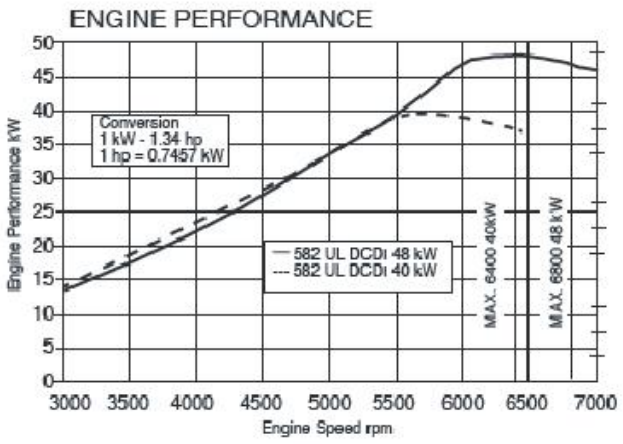
2.9 Fuel
Total fuel capacity 6.1 gal.
Total usable fuel 5.9 gal.
Approved types of fuel 90+ octane quality unleaded auto gasoline*

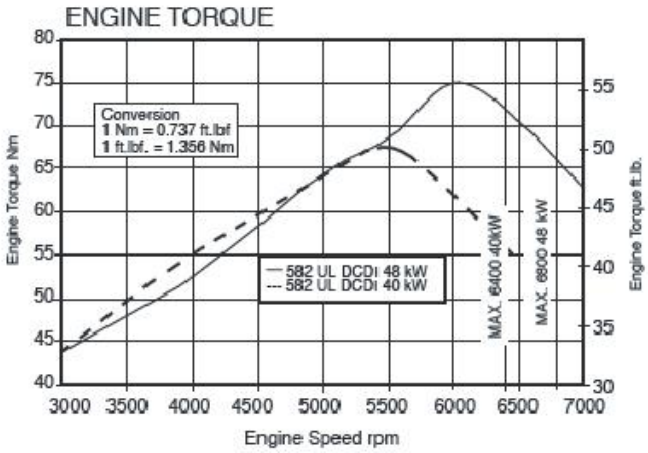
* refer to Rotax Operators Manual or www.flyrotax.com for current recommendations.

2.10 Maximum engine power output

Rotax 582 64hp / 48kW @ 6500 rpm

Graphs produced by Rotax





Rotax 912ULS 99 hp

Power setting	Engine speed (rpm)	Performance (kW)/(HP)	Torque (Nm) (ft.lb)		Manifold pressure (in.HG)
Take-off power	5800	73.5/100	121.0	89.24 ft.lb	27.5
max. continuous power	5500	69.0/90	119.8	88.36 ft.lb	27
75 %	5000	51.0/68	97.4	71.84 ft.lb	26
65 %	4800	44.6/60	88.7	65.42 ft.lb	26
55 %	4300	38.0/50	84.3	62.17 ft.lb	24

Rotax 912UL 80 hp

Power setting	Engine speed (rpm)	Performance (kW)/(HP)		Torque (Nm) (ft.lb)		Manifold pressure (in.HG)
Take-off power	5800	59.6	80	98.1	72.35 ft.lb	full throttle
max. continous power	5500	58.0	78	100.7	74.27 ft.lb	full throttle
75 %	5000	43.5	58	83.1	61.29 ft.lb	27.2
65 %	4800	37.7	50	75.0	55.32 ft.lb	26.5
55 %	4300	31.9	43	70.8	52.22 ft.lb	26.3

Fuel Consumption graphs in Section 5.5 of this manual

2.11 Applicable environmental limitations

Aircraft has removable fuel tank to allow re-filling in approved area.

2.12 Daytime VFR only *unless equipped with Optional Lighting Package.

3 – Emergency Procedures

3.1 General Information,

Stall due to low airspeed

In all cases where low air speed has caused an inadvertent stall the aircraft will continue out of control until a flow of air is re-established over the wings.

The immediate reaction must be STICK FORWARD.

Push the stick fully forward until the aircraft has recovered flying speed, and then ease back on the stick till normal flying attitude.

Resist the temptation to pull the nose up.

Spins

NOTE: "LIMITED AEROBATICS"

**** Note: Aerobatic Maneuvers limited to approved maneuvers for the Dragonfly and performed by a Pilot with proper training in the "Dragonfly Aerobatics Course".**

**** Caution: Engine is limited to positive G forces at all times. Engine damage or failure may occur if negative G forces are held for more than a few seconds.**

In all cases where low air speed has caused an inadvertent stall and spin, the control response reaction must be:-

STICK FULL FORWARD
and then
FULL OPPOSITE RUDDER

That means if you have entered a spin to the **LEFT push hard on the RIGHT rudder pedal**.

Once the spin has stopped, reduce power to avoid over speed, **centralize the controls** and gently recover from the dive.

Reset the throttle power setting as required.

3.2 Airspeeds for Emergency Procedures

Best Glide V_Y 42-47 mph depending upon weight
Rapid decent less than V_{NE} **66 mph.**

3.3 Emergency Checklist.

The simplicity of the Aircraft does not require an order or process during an Emergency Procedure other than normal pilot processes of flying the aircraft and using good judgment.

3.3.1 Engine fire during start

Master switch OFF
Engine ignition to OFF
Move away and remain clear of aircraft.

3.3.2 Engine failure during takeoff

Stick Forward, Attitude to best glide speed. Vy 42–47 mph.
If the engine fails at altitudes below 100m/300ft above ground level do not attempt to restart the engine.
Conduct an **emergency landing** as described below:
Land into the wind, or uphill if possible, At lower than 300' land straight ahead or slightly off to the side. Always monitor the airspeed closely and maintain forward airspeed. Resist the temptation to pull back on the stick to stretch the glide. Do not turn close to the ground.
The optimum glide speed with engine off is 42 mph solo to 47 mph dual. Once an adequate landing area has been reached maintain minimum of 45mph solo to 50 dual, until about 10ft above ground. Ease back on the controls and start a flare for landing at 3 feet AGL. With the engine idling, excess speed will quickly diminish when leveling out.

3.3.3 Loss of engine power in flight

Attitude to best glide speed. Nose down to maintain speed.
If the engine fails at altitudes above 100m/300ft above ground level, an attempt to restart can be made.
Ensure ignition is on and engage starter, ensuring the throttle is forward of the idle position. The engine will turn quicker than on the ground due to airflow over the propeller. Closely monitor airspeed and maintain at or above 35mph. If a restart is **not possible by 100m/300ft** then carry out an emergency landing as above.

3.3.4 Emergency landing without engine power

Same as 3.3.2 & 3.3.3 above

3.3.5 Precautionary landing with engine power

Use normal landing procedure or the appropriate landing procedure listed above.

3.3.6 Fire in flight

Master switch OFF
Engine ignition to OFF
Descend at less than V_{NE} **66 mph.**

Land at nearest reasonable site.

3.3.7 Loss of oil pressure (Not Applicable w/582)

912 - Look for safe landing spot, throttle back as soon as possible, shut engine off as soon as possible.

3.3.8 High oil pressure (Not Applicable w/582)

912 - Likely not an Emergency. However, Look for safe landing spot, throttle back as soon as possible, shut engine off as soon as possible.

3.3.9 Emergency descent

Throttle closed
Nose down attitude of approx. 45 degrees
Descend at close to but more than **V_{NE} 66 mph**
Refer to 3.3.2 for landing procedure.

3.3.10 Alternator failure

This is not an emergency situation. The engine is not affected when the electrical system is not charging. The master switch can be turned off to conserve battery but this will shut off the EIS (Engine Information System) and other powered items. . Land as soon as is practical and repair the problem.

3.3.11 Overvoltage

If voltage exceeds 16V the master switch should be turned off to prevent the battery from over-heating. Land as soon as is practical and repair the problem. The EIS warning level should be set to 14.9 volts DC.

3.3.12 Inadvertent spin

In all cases where low air speed has caused an inadvertent stall and spin, the control response reaction must be:-

STICK FORWARD TO RELEAVE BACK PRESSURE that caused the Stall
and then
FULL OPPOSITE RUDDER

That means if you have entered a spin to the **LEFT push hard on the RIGHT rudder pedal**.

Once the spin has stopped, reduce power to avoid over speed, **centralize the controls** and gently recover from the dive.

Reset the throttle power setting as required.

3.3.13 Inadvertent Icing Encounter (Carb Icing)

Structural With the open cockpit the likelihood of inadvertent icing is minimal. Should this occur, exit the icing area in the direction from which you came.

Carburetor Carb Icing is extremely rare on the 582 and 912. However, our experience has shown that it can occur at a **power setting between cruise and below full throttle and outside air temperatures between 68 and 74degrees F (20 – 24 C)**. If this occurs go to full throttle and you will hear the engine clear up within a minute. Then you can return to the desired throttle setting and be vigilant for reoccurrence of ice.

3.3.14 Loss of primary instruments

This should not be an emergency in this aircraft. Land at an appropriate area and repair the problem.

3.3.15 Loss of flight controls.

Failure of elevator

The Horizontal Stabilizer is fixed at 13 degrees negative to the wing. Level flight can be maintained by increasing or decreasing air speed, with throttle use & use of the trim tab.

Should pitch be uncontrollable after an elevator failure even after experimenting with the throttle & trim tab, shut down the engine and operate the emergency parachute at a time that is suitable.

Failure of ailerons

The Dragonfly's ailerons double as flaps and are in permanent flap position. Should one aileron fail take immediate steps to balance the aircraft with the other and final balance with the rudder. Should both fail and the aircraft is uncontrollable with the rudder then the pilot should operate the emergency parachute after shutting down the engine.

Rudder failure

Use the ailerons to steer the aircraft by gentle banking to achieve direction. Land the aircraft immediately following any control surface failure or suspect operation.

4 – Normal Procedures

4.1 Preflight Check (The same type of inspection should be done as Post Flight Inspection)

NOTE: A Post Flight Inspection may find issues that require maintenance or repair prior to next flight.
refer to Figure 4 Pre-Flight Areas on page 13

Every time the plane is prepared for flight the entire aircraft must be subjected to a pre-flight check whereby the pilot visually checks the aircraft to ensure that the aircraft is in a condition for "Safe Operation".
Conduct the pre-flight check as a walk around the aircraft starting at the same point each time, to ensure that every part of the structures, cables, attachments and components are inspected. Every part or component must be free of excessive wear, defect, tears, cracks, etc. refer to Figure 4 Pre-Flight Areas.

4.1.1 Aircraft and engine controls

For each seat check that the rudder pedals and stick move freely into all extreme positions. Check the links and connections on the stick and rudder to ensure that they are connected correctly and secured.

Check the condition of the seats and check that the seatbelts are securely fastened. Check that the fuel tank is securely fastened and with the cap screwed tight and containing the sufficient amount of fuel for the intended flight time.

4.1.2 Instruments

Check the Pitot Tube orifice is clear of obstructions. (*A simple test can be done to check that airspeed indicator works by blowing from several inches away, across the Pitot Tube, **NEVER BLOW DIRECTLY INTO THE PITOT TUBE** as this can permanently damage the instrument. Ensure that the indicator returns to zero position.)*
Check the correct indicating positions of the other instruments.

4.1.3 Undercarriage and main wheels

Check (visually and by hand) that the tires have the correct air pressure. Check that the tires are free of any damage. Check that the wheel nuts are in place and not loose, and that the undercarriage legs/axles are securely fastened to the fuselage.

4.1.4 Emergency parachute

Check that the emergency parachute is securely fastened to the aircraft with the cover sitting in the correct position and with the bridle secured around the main root tube. Remove the safety pin from the release handle and stow in a secure position. Re Insert the safety pin in Post Flight Inspection. Minimum Pressure 4200 psi

4.1.5 Left part of the wing

Remove the inspection panel behind the parachute and inspect the inside of each side of the wing ensuring that all battens are in place and that all tubing and support cables are undamaged. Replace the inspection panel and secure using the Velcro strips. Check that the Dacron wing surface is free of holes or other damage. Check that each end of the strut and outside support cables are securely fastened on the fuselage, tail and wing respectively.
Check that the aileron is securely fastened to the wing and that it moves freely between the extreme positions. Check that the linkages and connections to the control surface are securely fastened.

4.1.6 Engine and propeller

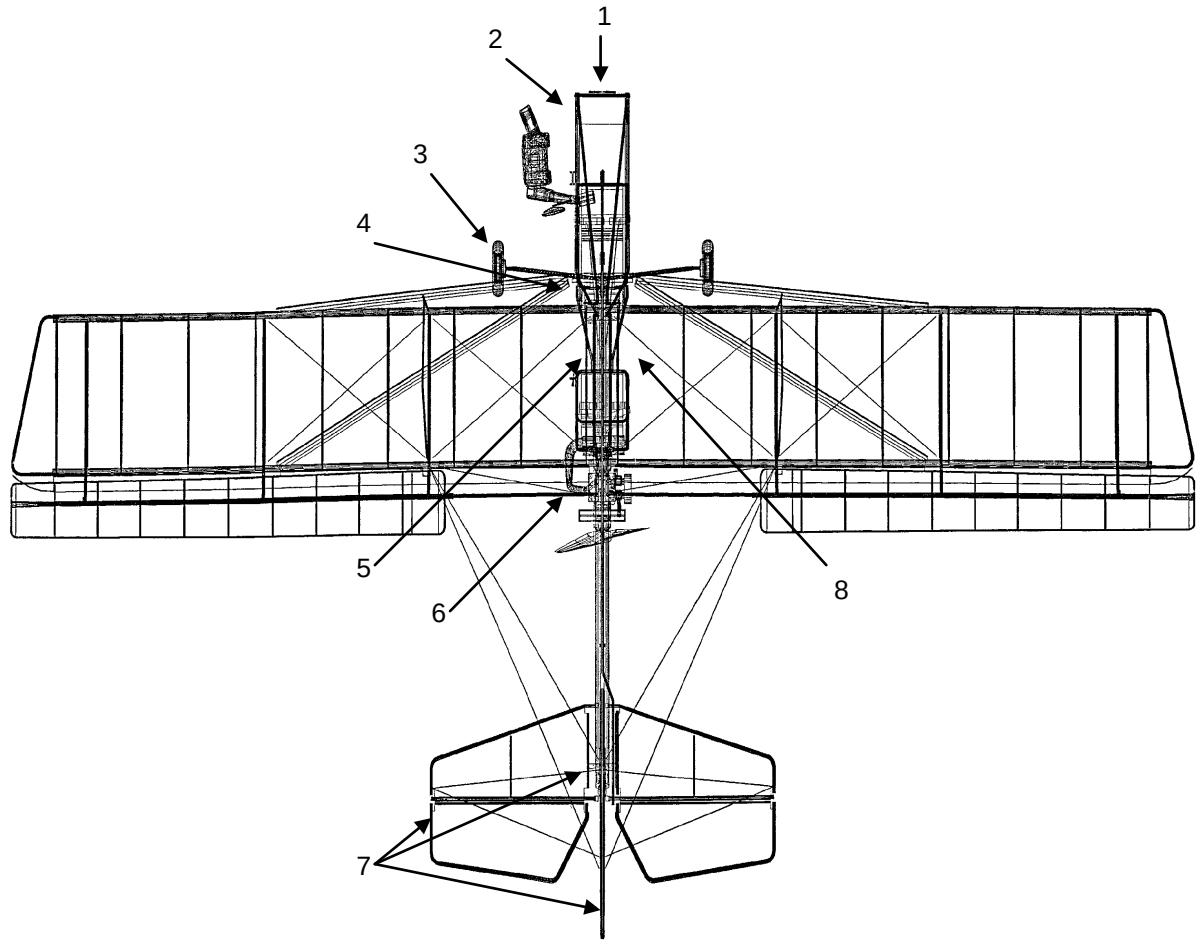
Check that the propeller is free of damage, especially delamination of the composite material. Check that the engine and muffler is securely fastened to the engine assembly plate and that this is securely fastened to the aircraft. Ensure that all safety wires are in place as required on the propeller, gearbox and engine bolts. Check that the oil tank and the radiator are filled to proper level (overflow bottle should have fluid at minimum mark cold) and check that the ignition cables are securely in place on the spark plugs. Insure Propeller bolts are secure, and inspect prop for damage.

4.1.7 Tail

Check that the rudder and elevator moves freely between the extreme positions.
Check that the linkage and connections for the control surfaces are securely fastened. Check (visually) that the tail wheel tire has the correct air pressure and is free of damage. Check that the wires from the rudder pedals are connected correctly to the steering plate. And that supporting cables are free of defect or wear.

4.1.8 Right part of the wing. Same as for the inspection of the left wing. 4.1.5 above

Inspect each side of the wing ensuring that all battens are in place and that all tubing and support cables are undamaged. .
Check that the Dacron wing surface is free of holes or other damage. Check that each end of the strut and outside support cables are securely fastened on the fuselage, tail and wing respectively.
Check that the aileron is securely fastened to the wing and that it moves freely between the extreme positions. Check that the linkages and connections to the control surface are securely fastened.



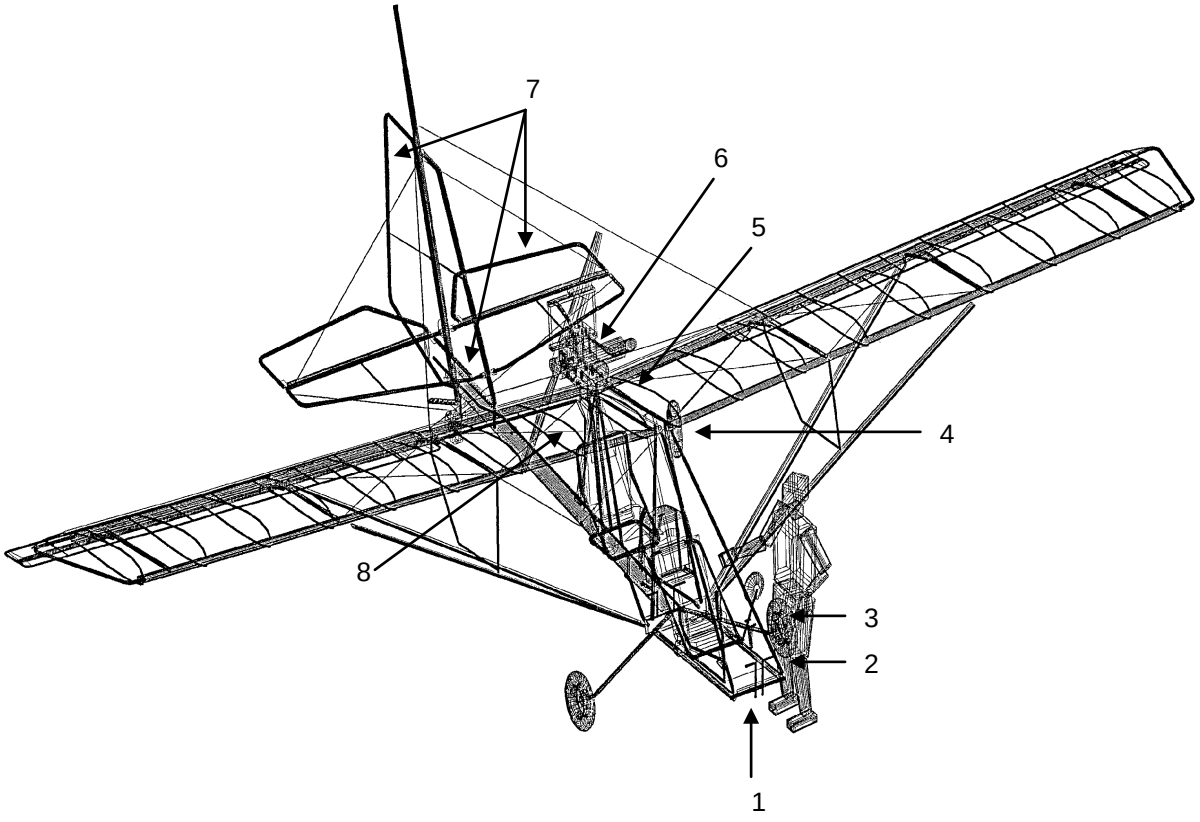


Figure 4 Preflight Areas

4.2 Engine starting

<u>WARNING</u>: Do Not attempt Hand starting by turning the propeller is Very Dangerous. Always use the electric start system.

FUEL: Approved types of fuel, 90+ octane quality unleaded auto gasoline* (use of 100 LL requires additional provisions listed in current Rotax manuals)

* refer to Rotax Operators Manual or www.flyrotax.com for current recommendations.

OIL: **582 Approved*** types and brands of TCW-III mixed 50:1

912 Approved* types and brands listed in the Current Rotax 912 manuals

* refer to Rotax Operators Manual or www.flyrotax.com for current recommendations.

STARTING THE ENGINE;

1. Ensure rear seat belt is fastened so that it will not fly into prop and no other item is loose that will be drawn into the propeller stream.
2. Pump fuel to the carburetors by operating the squeeze bulb in the fuel line till the bulb is firm.
3. Ensure that the throttle is in **Idle Position (Closed)**
4. Choke on (Cold Start)
5. Check that prop is clear of bystanders.
   (When you are ready, look both sides and call loudly **<u>"CLEAR PROP")</u>**
6. Ensure that the front of the aircraft is clear.
7. Operate brakes. (On)
8. 582 Pump bulb until it beomes hard. Pump primer 2-3 times.
   912 Equipped with Electric Boost Pump, run pump until fuel is seen returning to tank through the return line.

9. **Call "<u>CLEAR PROP"</u> to warn observers, & look to insure it is clear**.

10. Turn IGNITION Switches ON and Press Starter Switch to Start.

Normally the engine will start within 2 seconds. **Do not crank the engine more than 10 seconds if it does not start**. Longer operation may overheat the starter motor.

(582 only -- Cold conditions require more priming. Pump primer twice more and try again.)
The behavior of the engine will indicate the problem. In most cases it is too much or too little fuel to suit the temperature.

Should the engine not start after three or four attempts then it is possible that the engine is flooded with fuel.
To balance this situation, open the throttle to allow more air to be drawn in.

CAUTION: With the throttle open the aircraft may surge forward when it starts. **Be ready to Close Throttle.**

Operate the starter with one hand on the throttle to immediately pull the **throttle back to idle or low power** if the engine starts and be ready to **SWITCH OFF** if an emergency arises.

When the engine starts allow it to idle at 2000 – 2200 rpm for a full minute or longer to allow the engine to reach operating temperature. Let the engine warm up properly before applying too much power!
582 Coolant to 140 degrees F, before exceeding 3000 rpm's.
912 Oil Temperatures to 120 degrees F, before exceeding 3000 rpm's.
IMPORTANT NOTE: A thorough warm up is essential to the longevity to the engine life and performance.

4.3 Taxiing

The Rudder pedals operate rudder and tail wheel steering. Control is easy and turning radius is average.
Taxiing in cross wind up to 15 mph creates no problem.
Both the rudder and tail wheel turn the aircraft in the same direction.

For a left turn **PUSH LEFT PEDAL**
For right turn **PUSH RIGHT PEDAL**

Cont'd next page

At times Low Speed Taxiing can be improved by pulling up elevator to hold the rear wheel firmly on the ground. When taxiing down wind keep the stick in Neutral Position.
When attempting to taxy across wind lean the stick into the wind to reduce lift on the upwind flaperon. Failure to keep the aircraft balanced can lead to Ground Loops.

4.4 Normal takeoff

Checklist (sample)

Immediately prior to takeoff the pilot must go through the following Start Checklist:

1) Seatbelts securely buckled
2) Free movement of rudder pedals and stick to the extreme positions.
3) Safety pin removed from parachute release.
4) Sufficient fuel in tank for the intended flight time
5) Engine warmed up sufficiently Water Temp 140 F Choke OFF
6) Electrical instruments ON
7) Adjust Altimeter
8) Check wind direction.

Procedure

When the runway and the flight path approach to the runway are clear, taxi into the take off position.

Always take off into prevailing wind. Takeoffs can be conducted in cross wind conditions up to 15 mph.

Release the brakes and when the aircraft starts to roll keep the stick slightly pulled back. At 20 mph the tail wheel will lift off. With the tail wheel 1ft off the ground keep accelerating while keeping the aircraft on a straight line with positive and firm rudder movements. At 30 mph the aircraft will lift off in the ground effect. Pull the stick back slightly and keep the aircraft in an even climb at a constant speed of 45-50 mph.
At an altitude of 300 feet reduce the throttle if needed and keep climbing at 40–45 mph.

In very calm conditions and after extensive experience with the aircraft the climb can be performed with a single person onboard at 30-35 mph. At this speed the aircraft will climb best.

Important

During the climb it is imperative that the aircraft is not pulled into too a steep climb angle, the aircraft will still be controllable but it will stop climbing. Inexperienced pilots can unwittingly bring the aircraft in such a situation especially when flying over obstacles.

Performance values

The stated values are valid at sea level in nil wind conditions and at temperature of 60 degrees F.
The takeoff weights in the two cases are 750lb solo and 950lb two place on an even dry short grass runway.
Higher temperature, weight or altitude will require additional runway.

From a standing start the distance to take off : *(distances performed by factory test pilot, results vary based on pilot skills)*

582UL Solo ≈ 225ft. Gross Weight 1080 ≈ 300 – 345 ft.
912UL Solo ≈ 215 ft. Gross Weight 1080 ≈ 280 – 335 ft.
912ULS Solo ≈ 185 ft. Gross Weight 1080 ≈ 245 – 300 ft.

Take off distance to clear 50ft high obstacle: *(distances performed by factory test pilot, results vary based on pilot skills)*

582UL Solo ≈ 650ft Gross Weight 1080 ≈ 950ft
912ULS Solo ≈ 600 ft. Gross Weight 1080 ≈ 790 - 825 ft.
912ULS Solo ≈ 450 ft. Gross Weight 1080 ≈ 590 - 605 ft.

Take off speed:

Solo	38 mph
Two place	42 mph

Speed on clearing a 50ft obstacle:-

Solo	37 mph
Two place	44 mph

4.5 Best Angle of Climb speed (Vx)

582UL 37 mph ≈ 750 fpm (solo) 44 mph ≈ 350 fpm @ GROSS WEIGHT
912UL 37 mph ≈ 900 fpm (solo) 44 mph ≈ 500 fpm @ GROSS WEIGHT
912ULS 37 mph ≈ 1100 fpm (solo) 44 mph ≈ 750 fpm @ GROSS WEIGHT

4.6 Best Rate of Climb speed (Vy)

582UL 42 mph ≈ 850 fpm (solo) 47 mph ≈ 350 fpm @ GROSS WEIGHT
912UL 42 mph ≈ 1000 fpm (solo) 47 mph ≈ 550 fpm @ GROSS WEIGHT
912ULS 42 mph ≈ 1200 fpm (solo) 47 mph ≈ 800 fpm @ GROSS WEIGHT

4.7 Cruise *(Dragonfly is inefficient at higher speeds.)*

582UL Cruise at ≈ 4600-5000 rpm will give ≈ 45-50 mph solo
Consumption at cruise is ≈ 4.0 US gal per hour
Range is approximately ≈ 45 - 50 miles (no wind 500' MSL with 30 min reserve)

912ULS & 912UL Cruise at ≈ 4100-4300 rpm will give ≈ 49 - 54 mph solo
Consumption at cruise is ≈ 2.8 US gal per hour
Range is approximately ≈ 70 - 80 miles (no wind 500' MSL with 30 min reserve)

4.8 Approach (Normal Approach Speed is 50 - 55 mph.)

Always land into the prevailing wind when possible

At idle the airspeed should always be kept at least at 38 mph. At half throttle the airspeed should always be kept at least at 40 mph.

Conduct a conventional approach to the runway with a downwind leg, a base leg and a final approach while observing any special landing pattern rules that may be in force at the airfield. Always keep a good lookout for other aircraft during the landing

Under normal conditions make the final approach with ≈ half throttle. Always make the final approach high with enough height to make the runway even with loss of the engine.

4.9 Normal landing

When the aircraft is 3 feet above the ground pull the stick back slowly and bring the aircraft into level flight above the ground while using the throttle to keep the aircraft at constant altitude and a speed of ≈ 38 mph. Then ease the throttle back while pulling slowly back on the stick and bring the aircraft to the ground gently. The correct landing speed is ≈ 28 - 35 mph. When the aircraft touches down pull the throttle all the way back and bring the aircraft to a halt by using the brakes.

When the Dragonfly is on the ground with all 3 wheels the wing has an angle of incidence of 13 degrees.
This is sufficient angle of attack to lift the aircraft off the ground at flying speed. Therefore when you wish to land observe the old proverb **"You don't land a plane, you fly it till it stops flying"**

Hold the plane off the ground till the tail wheel touches first. Then reduce throttle.

The aircraft will come to a halt quickly if landed in this fashion as the wing is at a high angle of incidence and creates maximum drag.

Experience will allow you to land by greasing it in on all three wheels together or front wheels first.

4.10 Short field takeoff and landing procedures

Take-off Short Field

1) Position at farthest point back on runway possible,
2) Hold Brakes with stick all the way back.
3) Increase power to maximum and release brakes.

4) As speed increases stick goes smoothly to neutral position to reduce angle of attack. At Vx rotate nose up for take-off and maintain until clear of obstacle then accelerate to Vy

Landing Short Field

1) Position for Normal landing till finial.
2) Carry extra speed and a steep approach angle with your aiming point just a little short of your intended touch down target.
3) Throttle should be closed as soon as touch-down target is assured.
4) Use a forward slip if you are a little high or a slightly more shallow approach if low. Always maintain some extra speed thru the gradient as the Dragonfly's High Lift, High Drag Airfoil can lose speed quickly.
5) Round out two to three feet above the landing surface.
6) Pull back on the elevator just enough to maintain level flight. As the airspeed bleeds off the Dragonfly will start to settle.
7) Pull full back elevator. Keeping the stick full back after touch-down to put steering weight on the tail wheel, and apply brakes as necessary.

4.11 Soft field takeoff and landing procedures

Take-off Soft Field

1) Keep aircraft in motion and avoid use of the brakes.
2) When aligned with the center of the runway, go to full power smoothly.
3) With stick neutral or slight back pressure maintain near 3 point attitude until take-off. Lower nose and accelerate to Vy.

Landing Soft Field

1) Position for Normal landing through the Finial approach.
2) After rounding out leave the throttle open for 2,000 to 2,200 RPM's. when the Dragonfly begins to settle.
3) Stop pulling back on the elevator and allow the main landing gear to touch down. Close the throttle and allow the tail wheel to land.
4) Maintain enough taxi speed to keep from sinking into the soft field. Brakes should be used only as a last resort.

4.12 Aborted landing procedures

Add power and go to best rate of climb maintain runway heading and re-enter pattern.

4.13 Any other useful pilot information

Because the Dragonfly is light and high in drag, speed is lost quickly when thrust is lost. Nose Down Pitch Attitude must be addressed much more quickly than conventional aircraft .

4.13.1 EMERGENCY PARACHUTE SYSTEM

The manufacturer's recommendations for mounting and maintaining the emergency parachute must always be adhered to.
The parachute has its own operations manual that is supplied separately with this aircraft.
It is especially important to protect the parachutes from moisture and heat. If the parachute ever gets moist or wet it must be opened, dried and repacked by a "Qualified Person".
Parachutes with rocket deployment have a limited life span of the rockets.
The parachute and rocket should be returned to Manufacturer each 5/6 years for inspection and repack. See manual.
There is a safety pin to prevent accidental deployment. This must be removed before each flight and replaced after each flight.
Before each flight check that the parachute is securely mounted on the aircraft and that the bridle is securely attached to the main root tube.
** Refer to current SECOND CHANTZ Recovery System Manual

4.13.2 AIRCRAFT DISASSEMBLY FOR TRANSPORT

Transport on a trailer requires a trailer of sufficient size to accommodate the aircraft and provide protection while the aircraft is in transit. It also requires cradles or support means to avoid damage to wing and control surface fabric and to prevent impact damage to the airfoil surfaces.

1: Remove propeller- 6 mounting bolts
2: Disconnect throttle and carburetors
Disconnect Fuel Line and primer
Disconnect multi plug wiring
3: Disconnect starter cable
Remove gap cover and wing straps
4: Remove engine by removing 6 bolts through the Lord isolation mounts
5: Disconnect rear wing to tail cables at tail and fuselage
6: Disconnect Aileron push rods and Aileron torque tube
7: Disconnect struts at bulkhead and jury struts.
8: Remove 4 wing mounting bolts and remove wings with struts attached to wings.
Fold jury struts to main strut.
Fold main struts to wings.
9. Mount wings on trailer.
10. Disconnect horizontal stabilizer support cables by removing AN3 bolt at Stabilizer ends.
Disconnect elevator connecting bracket.
11. Horizontal stabilizer and elevator will fold up to the vertical stabilizer and Rudder.
Tie both the horizontal stabilizer tips together.
12. The fuselage and cockpit is easily handled and mounted on or in a trailer.

NOTE: Some of this procedure can be avoided by leaving the engine and propeller mounted if your trailer has sufficient space. However the engine must be supported in the trailer when the wings and struts are removed.

For assembly reverse the procedure. Two experienced people can assemble a Dragonfly in 20 min
Maintenance:- refer to Maintenance Manual for instructions for "Continued Airworthiness".

5 – Performance

5.1 Takeoff total distance over a 50 foot obstacle (distances performed by factory test pilot)

582UL Solo ≈ 650ft Gross Weight 1080 ≈ 950ft
912ULS Solo ≈ 600 ft. Gross Weight 1080 ≈ 790 - 825 ft.
912ULS Solo ≈ 450 ft. Gross Weight 1080 ≈ 590 - 605 ft.

5.2 Landing total distance over a 50 foot obstacle (distances performed by factory test pilot)

582UL Solo ≈ 500ft Gross Weight 1080 ≈ 590 - 655 ft.
912UL & 912ULS Solo ≈ 525 ft. Gross Weight 1080 ≈ 590 - 655 ft.

5.3 Rate of climb

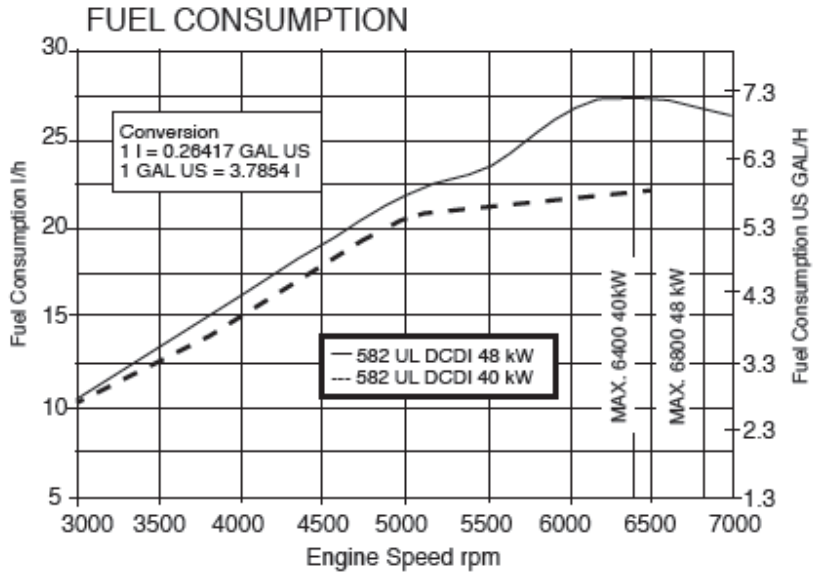
582UL 42 mph ≈ 900 fpm (solo) 47 mph ≈ 350 fpm @ GROSS WEIGHT
912ULS 42 mph ≈ 1200 fpm (solo) 47 mph ≈ 800 fpm @ GROSS WEIGHT

5.4 Cruise speeds

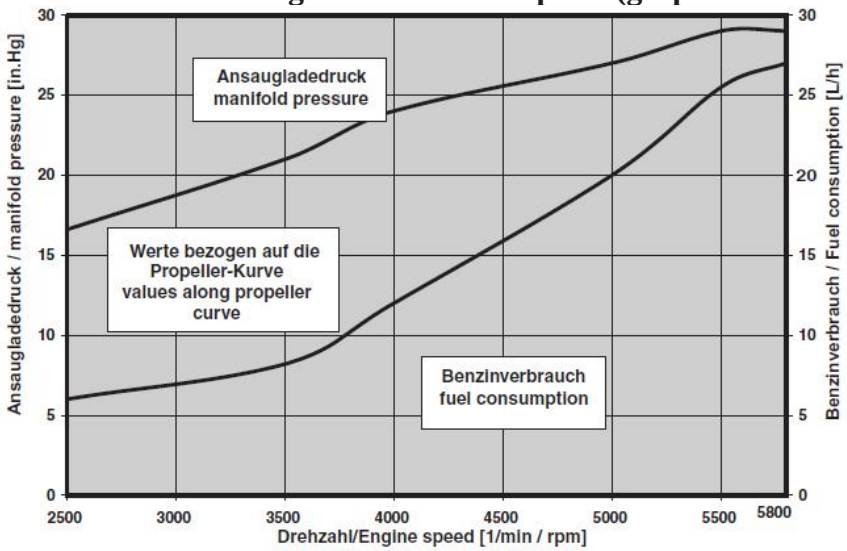
582UL
Cruise at ≈ 4600-5000 rpm will give ≈ 45-50 mph solo
Consumption at cruise is ≈ 4.0 US gal per hour
Range is approximately ≈ 45 - 50 miles (no wind 500' MSL with 30 min reserve)

912ULS
Cruise at ≈ 4100-4300 rpm will give ≈ 49 - 54 mph solo
Consumption at cruise is ≈ 2.8 US gal per hour
Range is approximately ≈ 70 - 80 miles (no wind 500' MSL with 30 min reserve)

5.5 582UL RPM setting and fuel consumption (graph from Rotax 582 Manual)



912ULS RPM setting and fuel consumption (graph from Rotax 912 Manual)

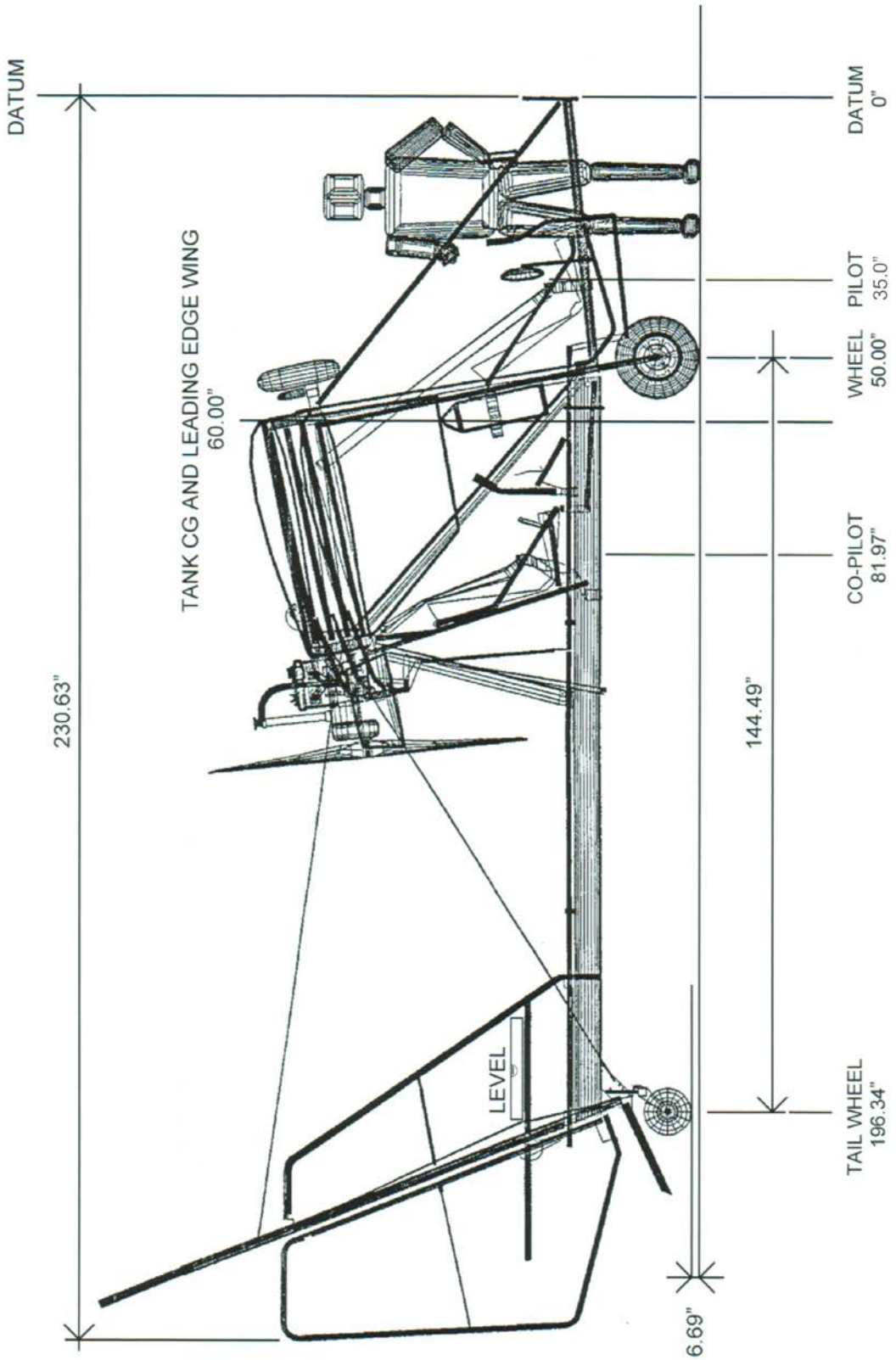


Power output graphs in Section 2.10 of this manual

Our tests & use have shown 582 ≈ 4 gph @ 5000 - 5200 rpm cruise (results may vary)
912 ≈ 2.3 – 2.6 gph @ 4100 – 4300 rpm cruise (results may vary)

6 – Weight and Balance and Equipment List

6.1 Weight and Balance Chart



6.2 Operating weights and loading (occupants, baggage, fuel, ballast)

The CG must never be further FORWARD than 76.1" in. from the Datum nor further AFT than 83" in. from the Datum.
The aircraft must never be flown solo from the back seat.
The pilot minimum weight of 60 kg in the front seat is necessary to keep the aircraft in its CG range.
The CG range as a percentage of the chord of the wing is from 35.7% with the lightest pilot to 26.1% with the heaviest pilot.

The figures shown are typical of a Dragonfly fitted with a 582 liquid cooled Rotax engine. The limiting figures are still valid if the aircraft is fitted with other engine types. Reference should be made to the aircraft specific figures recorded in Section 6.3.4 Page 22

The empty weight CG should be 95.9in from the Datum or 55.6% of the MAC.

6.3 Center of gravity (CG) range and determination.

The weight and position of the center of gravity (CG) of the empty aircraft must be established to conduct load sheet calculations. The aircraft must be weighed and measured in a fixed position and attitude and in windless conditions with wings level. Use a plumb line to project the following positions to the ground for measurements. The Datum is the point from which all measurements are taken and for the Dragonfly is the nose or cockpit front cross tube. The attitude selected is to raise the tail wheel till the Horizontal Stabilizer is level by measurement with a spirit level. (See fig. 2) 6.1 The weights and measurements are recorded in this position and results as follows; - (**note typical aircraft**) **Use only lbs. and inches, Metric Units must be converted first.**

The Mean Aerodynamic Chord (MAC) is calculated by adding the wing and flaperon area and divide by span.

MAC = AREA / MEAN SPAN = 183.10 ft sq / 34.08ft = 5.37ft / 64.50in

1.	DATUM	-	Cockpit front cross tube		0.00
2.	Pilots Pelvis position	-	Pilot CG		35.0in
3.	Front Axle	-	Front Wheels		50.0in
4.	Leading Edge of Wing	-			60.0in
5.	Fuel Tank Center	-			60.0in
6.	Rear Seat Pelvis position	-	Co Pilot CG		82.0in
7.	Tail Wheel Axle	-			196.0in

EMPTY WEIGHT MEASURED AS FOLLOWS and the Moment Arm from DATUM used to calculate moments. **(Note – these readings for an Example Only of typical aircraft, your aircraft may vary!)**

	Empty Weight Mass	Moment Arm	Moments
Front Rt. Wheel	179.0lb	50.0in	8950in lb
Front Lt Wheel	174.5lb	50.0in	8718in lb
Rear Wheel	162.0lb	196.0in	31752in lb
Total Weight	515.5lb	Total Moments	49420in lb

CG from Datum = Moment / Mass = 49420in lb / 515.5lb = 95.90in

The Leading Edge of the wing is 60.0in aft of Datum. The empty weight CG position from the Leading Edge is then:-

95.90in – 60in = 35.9in

As a percentage of MAC 35.9 / 64.5 = 0.556 55.6%

6.3.1 MAX. AFT CG WITH 133lb PILOT AND 11lb FUEL (example)

	Weight	Arm	Moment
Aircraft	515lb	95.9in	49388.5 in lb
Fuel	11lb	60.0in	660.0 in lb
Pilot	133lb	35.0in	4655.0 in lb
	659lb		54703.5 in lb

CG = MOMENT / MASS = 54703 / 659 = 83in

As a percentage of MAC

83 - 60 = 23 / MAC = 23 / 64.5 = 0.357 = 35.7%

6.3.2 CG WITH MAX FUEL & TWO 90 KG / 199 lb. PILOTS (example)

		Weight	Arm	Moment
Aircraft	=	515lb	95.9in	49388.5 in lb
Fuel	=	33lb	60.0in	1989.0 in lb
Pilot	=	199lb	35.0in	6965.0 in lb
Co Pilot	=	199lb	82.0in	16318.5 in lb
		946lb		74660.5 in lb

CG = MOMENT / MASS = 74660 / 946 = 78.92in

As a percentage of MAC

78.92 – 60 = 18.92 / MAC = 18.92 / 64.5 = .293 = 29.3%

6.3.3 Ballasting to Compensate for Light Pilot Weight Solo

582 will have minimum front pilot weight of 138# unless ballast is added to the lower front section of upper cockpit tube DFC 004 and/or DFC 005, near the rudder pedals. With 11 pound ballast in place, minimum pilot weight solo is 120 lbs. Any pilot weight less than 140 lbs, must accommodate with ballast as shown with this formula, 140-(pilot weight) * .61 = ballast needed. i.e. pilot weighs 98 lbs., then (140-98)*.61= 25.62 lbs of ballast required.

912 will have minimum front pilot weight of 175# unless ballast is added to the lower front section of upper cockpit tube DFC 004 and/or DFC 005, near the rudder pedals. With 32 pound ballast in place, minimum pilot weight solo is 120 lbs. Any pilot weight less than 175 lbs, must accommodate with ballast as shown with this formula, 175-(pilot weight) * .59 = ballast needed. i.e. pilot weighs 98 lbs., then (175-98)*.59= 45.43 lbs of ballast required.

Ballast Location: Place ballast in the form of Ankle weights from Wal Mart. These can Velcro to the very front of the pilot cage near the down tube connection by rudder pedals. These should rest the weight on the foot rest but be wrapped around cockpit tube DFC 004 and/or DFC 005

Make copies of this page for calculation worksheets

6.3.4 AIRCRAFT SPECIFIC WEIGHT AND CG POSITION

The CG must never be further **FORWARD than 76.1 in** from the Datum, nor further **AFT than 83in** from the Datum

Dragonfly Serial No:		
Weight at left main wheel:		**lb**
Weight at right main wheel:		**lb**
Weight at tail wheel:		**lb**
Empty weight with standard equipment:		**lb**
Maximum takeoff weight:	1080	**lb**
Maximum load:		**lb**
Empty weight CG. position		**inch**
CG position % MAC		**MAC**
Date:		
Inspector:		

6.3.5 Load Sheet EMPTY WEIGHT CALCULATIONS

	WEIGHT lb	**MOMENT ARM inch**	**MOMENT In/lb**
Left Front Wheel		50	
Right front Wheel		50	
Rear Wheel		196	
Fuel		60	
Pilot		35	
Co-Pilot		82	
Installed Equipment Totals			
Totals **W =**		Totals **M =**	
CG position **M/W**	**CG =**		

6.4 Installed optional equipment list affecting weight and balance or a reference as to where this information can be found.

Item	Location Inches from Datum	* Weight	= Moment
Totals to use above =	Do Not total these	Sum:	Sum:

7 – Description of Airplane and Systems

7.1 General

High Wing, High Drag, Tail Dragger, Open Cockpit, 2 Place, Pusher.

7.2 Airframe

Aluminum Tube & Fabric, Cable braced, Bolt Fastener Construction

7.3 Flight controls

Junker Style Ailerons, Conventional Stick & Rudder, using Push Rods, Bell-Cranks and Cables for operation

7.4 Instrument panel

Side mounted in fairing,
Engine Information System (EIS) w/ Warning Light refer to Appendix's A1(582) or A2 (912) for details
Standard 2 1/4" or 3 1/8" Falcon 0 – 80 mph Airspeed Indicator (for markings refer to Section 9.1 or Appendix C)
Rearview Mirror

7.5 Flight instruments

Airspeed Indicator (for markings refer to Section 9.1 or Appendix C)
Altimeter in EIS

7.6 Engines

Rotax 582UL 65 hp.
Mod 99, 2 Cylinder, 2 Cycle, Dual CDI ignition, Water Cooled, w/ 4:1 reduction Model C Gearbox,. or
Rotax 912UL 80 hp.
4 Cylinder, 4 Cycle, Dual CDI ignition, Water Cooled heads, w/ 2.24:1 Reduction Gear Drive or
Rotax 912ULS 100 hp.
4 Cylinder, 4 Cycle, Dual CDI ignition, Water Cooled heads, w/ 2.43:1 Reduction Gear Drive
**Refer to Engine Operating procedures in the Rotax Operators Manual

7.7 Propeller

582UL Bolly BOS3 72x60 SR 4 blade or Kiev Prop 71.5" 3 blade CW
912UL & 912ULS Kiev Prop 71.5" 3 blade CCW or Powerfin 72" 3 blade Type F.

7.8 Fuel and Fuel capacity

Capacity 6 US Gallons
582 90+ Octane Unleaded Auto Gas Premix 50:1 TCW-III 2 Cycle Oil
912UL 85+ octane unleaded auto gas, (100 LL may be used, but check provisions in Rotax Manuals.)
912UL 91+ octane unleaded auto gas, (100 LL may be used, but check provisions in Rotax Manuals.)

7.9 Oil

582 Approved* types and brands of TCW-III mixed 50:1
912 Approved* types and brands listed in the Current Rotax 912 manuals
* refer to Rotax Operators Manual or www.flyrotax.com for current Oil recommendations.

7.10 Operating Weights and Loading

Refer to Section 6 Weight and Balance Information

8 –Aircraft Handling and Servicing

8.1 Introduction

Refer to Rotax Manuals for information regarding Engine and Gearbox.

8.2 Ground Handling

Pulling by hand using the rudder pedals give steering ability to the pulling and pushing by controlling the tail-wheel alignment..

Pushing backwards - Hold rudder pedals forward firmly and tail wheel will release and turn backwards.

Lifting Wing to lift wheel off the ground - Should be done "BY HAND" at the front strut and wing attachment point.

8.3 Towing Instructions (Ground)

When towing with equipment like a Golf Cart
Attach rope to Datum Point at intersection of nose tubes
Tow Gently with a Competent Person in the Cockpit for Steering and Braking Operation

8.4 Tie-Down Instructions

Wings - Tie down at the top of front strut where it intersects with the wing There is a **Tie-Down Loop**.
Tail - **Tie-Down Loop** near rear wheel. or Choose a solid point in the tail where tie-down rope or chain will not damage the aircraft if pulled hard.
Note: DO NOT use the "Aero Tow Release Arm" or "Release Mechanism" to tie down.

8.5 Servicing, Fuel, Oil, Coolant, and other operating fluids,

Airframe - Hinge Points of Controls, Push Rod Guides and Cables should be lubricated with a PTFE "Dry Lubricant" Product like "Tri-Flow" or Ace Hardware, Sherline Products PTFE Dry Lubricant "Super Lube"
So that it will not attract and hold dust and dirt.

Rotax Engine - Refer to Rotax Owners Manual furnished with the Aircraft
Or online at www.flyrotax.com

8.5.1 Approved Fuel Grades and Specifications

Refer to Rotax Owners Manual furnished with the Aircraft
Or online at www.flyrotax.com
High Octane (90+), Quality Brand, Unleaded Auto Gas. 10% Ethanol is allowed, However, Gasoline containing Methanol should never be used.

8.5.2 Approved Oil Grades and Specifications

Refer to Rotax Owners Manual furnished with the Aircraft
Or online at www.flyrotax.com
2 Cycle TCW III oil.

8.6 Cleaning and Care

DO NOT use alkali base cleaners on fabric or aluminum

Fabric surfaces - Mild Cleaners like "Dawn Dish Soap" can be used

Metal Surfaces - WD-40 or similar light lubricant and NON ABRASIVE "Scotch Pad" or plastic bristled brush.

9 – Supplements

9.1 Additional Information

Rotax Engines - Refer to Rotax Owners Manual furnished with the Aircraft
And Rotax Maintenance Manual which can be down loaded
Online at www.flyrotax.com

EIS (Engine Information System) - refer to Grand Rapids Technologies Inc. EIS Manual Appendix A of this manual.

9.2 Operation of Equipment or Accessories

9.2.1 EIS refer to Appendix A

9.2.2 Bailey Release and Tow System Appendix D

9.3 Airplane Flight Training Supplement (FTS)

Located in Appendix B of this manual

9.4 Information Important to Owner/Operator

9.4.1 Owner/Operator Responsibilities (required by FAA & Consensus Standard ASTM F2245)

1) Each Owner/Operator of a LSA shall, Read and Comply with the Maintenance and Continued Airworthiness Information and Instructions provided by the manufacturer.
2) Each Owner/Operator of a LSA shall, be responsible for providing the manufacturer with current contact information where the manufacturer may send the owner/operator supplemental notification bulletins.
3) The Owner/Operator of a LSA shall, be responsible for notifying the manufacturer of any safety of flight issue or significant service difficulty upon discovery.
4) The Owner/Operator of a LSA shall, be responsible for complying with all manufacturer issued Notices of Corrective Action and for complying with all applicable Aviation Authority Regulations in regard to maintaining the Airworthiness of the LSA.
5) An Owner of a LSA shall, ensure that any needed corrective action be completed as specified in a notice, or by the next scheduled Annual Inspection as specified in the Notice..
6) Should an Owner/Operator not comply with any Mandatory Service Requirement, the LSA shall be considered not in compliance with applicable ASTM standards and may be subject to Regulatory Action by the presiding Aviation Authority (FAA).

9.4.2 Modifications, Improvements or Corrections

Modifications can only be done with an LOA (Letter of Authorization) from the manufacturer. Any modifications or modifications to the aircraft without an LOA may result in the loss of the Airworthiness Status of the Aircraft.

9.4.1.1 Safety Directives (SD) (similar to, but not equal to, AD's "Airworthiness Directives".)

The manufacturer may issue one of three types of Safety Directives:

A **Safety Alert (SA)** - for conditions that require immediate action and instructions

B Service Bulletin (SB) - for conditions that don't require immediate action but have a recommended future action

C Notification (N) - which doesn't necessarily recommend future action, but is primarily for promulgation of Continued Airworthiness Information.

9.4.3 Continued Operational Safety Reporting and Compliance

Owners have a Responsibility to report any Safety Concerns, Maintenance Problems and/or Equipment and /or Part Failure directly to the manufacturer as soon as practical.

9.4.3.1 Each owner/operator of a LSA shall read and comply with the maintenance and continued airworthiness information and instructions provided by the manufacturer.

9.4.3.2 When the manufacturer issues one of these directives, it will include information on exactly what needs to be done, by whom, how, and what parts and tools are needed. Aircraft logbooks must be updated to show completion of any Safety Directive**. Proper Compliance with Safety Directives is MANDATORY.**

9.4.3.3 The owner/operator of a LSA shall be responsible for complying with all manufacturer issued notices of corrective action and for complying with all applicable aviation authority regulations in regard to maintaining the airworthiness of the LSA.

9.4.3.4 An owner of a LSA shall ensure that any needed corrective action be completed as specified in a notice, or by the next scheduled annual inspection.

9.4.3.5 Should an owner/operator not comply with any mandatory service requirement, the LSA shall be considered not in compliance with applicable ASTM standards and may be subject to regulatory action by the presiding aviation authority.

9.4.3.6 Each owner/operator of a LSA shall be responsible for providing the manufacturer with current contact information where the manufacturer may send the owner/operator supplemental notification bulletins.

9.4.3.7 The owner/operator of a LSA shall be responsible for notifying the manufacturer of any safety of flight issue or significant service difficulty upon discovery.

9.4.4 Owner Change of Address Notice

In order to continue the airworthiness of each aircraft in accordance with the Quality Assurance & Continued Airworthiness Procedures, the Owner shall notify the manufacturer **within 30 days of permanent change of address** and other contact information. This information is held private and not shared with anyone outside the company, except the FAA and Quality Assurance Monitoring Firm during audits on a visual level only.

We Need:

Owners Name
N Number
Aircraft Serial Number
Previous Address w/ City, ST Zip Country
New Address w/ City, ST Zip Country
Phone Numbers

This can be done by Mail to:
Pitman Air
Ed Pitman
1840 Airport Blvd.
Red Bluff, CA 96080
Or on our website:www.pitmanair.com/dagonfly

10 – Required Placards & Markings

10.1 Airspeed Indicator Falcon 0-80 mph 2 1/4" or 3 1/8" 0-80 mph
- a. Minimum Controllable Airspeed Range (Light Green Arch) 30 – 38 mph
- b. Normal Operating Range (Green Arch) 38 - 55 mph
- c. Caution Range (Yellow Arch) 55 – 66 mph
- d. Never Exceed Speed Vne (Red) **66 mph**

10.2 Throttles Open / Close Arrows
10.3 Fuel Tank Premium Unleaded Premix 50:1 2 Cycle TCW-III
10.4 Master Switch On/Off
10.5 Electrical Box
- Mag 1 On/Off
- Power On/Off
- Mag 2 On/Off
- Starter Push to Start

10.6 Fuses EIS Fuse 5 amp & AUX 5 amp
10.7 Tire Pressure on Rim " Inflate 20 psi Max."
10.8 Gearbox GEAR OIL 75W – 140
10.9 Passenger Warning Standard 1" x 3 ¼" Warnings from Aircraft Spruce : Special "Light Sport" or "Experimental" as appropriate.
10.10 "Light Sport" or "Experimental"

Abbreviations:

AOI — Aircraft Operating Instructions
C — Celsius
CAS — Calibrated air speed
cm — Centimeter
cm3 — Centimeter Cube
cu. in — Cubic Inches
F — Fahrenheit
ft — Feet
ft. lbs — Foot Pounds
FTS — Flight Training Supplement
Hg — Mercury
HP — Horse Power
hr(s) — Hour(s)
IAS — Indicated Air Speed
in — Inch
in. lbs — Inch Pounds
ISA — International Standard Atmosphere
Kg — Kilogram
km/hr — Kilometers per hour
kt(s) — Nautical Mile per Hour (knot) (1 nautical mph = (1852/3600) m/s)
kW — Kilowatt
lb(s) — Pound(s) (1 lb = 0.4539 kg)
m — Meter
Max — Maximum
mb — Millibar's
Min — Minimum
min — Minute(s)
MIP — Maintenance and Inspection Procedures
mm — Millimeter
MPH — Miles per hour
MTOW — Maximum Take-Off Weight
N — Newton
Nm — Newton Meter
PIC — Pilot In Command
POH --- Pilot Operating Handbook in lieu of AOI
psi — Pounds per Square Inch gage pressure
RPM — Revolutions Per Minute
s — Seconds
SI — International System of units
sq. ft — Square Feet
sq. m — Square Metre
TOSS — Take Off Safety Speed
Va — Maneuvering Speed
Vc — Operating Cruising Speed
Vdf — Demonstrated Flight Diving Speed

Vh — Maximum Sustainable Speed in straight and level flight

Vne — Never Exceed Speed

Vso — Stalling Speed, or the minimum steady flight speed in the landing configuration

Vs1 — Stalling Speed, or the minimum steady flight speed in a specific configuration

Vt — Maximum Glider Towing Speed

Vx — Speed at which Best Angle of Climb is achieved

Vy — Speed at which Best Rate of Climb is achieved

W — Empty Weight (including required minimum equipment, unusable fuel, maximum oil, and where appropriate, engine coolant, and hydraulic fluid)

Units:

Speed:

Kts (Knots) = 1.15 mph (miles per hour) = 1.84 km/hr 1 km/hr = 1.6 MPH

Pressure:

PSI = Pounds per Square Inch in
Hg = inches of Mercury
mb = millibar

Distances:

in. = inches = 25.4 millimeters
ft = foot (feet) = .305 meters

Weights:

Kg = kilograms = 2.2 lbs = 2.2 pounds

Misc.
1 Pound (Ib) = 0.4536 Kilogram (kg)
1 Pound per sq in (psi) = 6.895 Kilopascal (kPa)
1 Inch (in) = 25.4 Millimeters (mm)
1 Foot (ft) = 0.3048 Meter (m)
1 Statute mile = 1.609 Kilometers (km)
1 Nautical mile (NM) = 1.852 Kilometers (km)
1 Millibar (mb) = 1 Hectopascal (hPa)
1 Millibar (mb) = 0.1 Kilopascal (kPa)
1 Imperial gallon = 4.546 Liters (I)
1 US gallon = 3.785 Liters (I)
1 US quart = 0.946 Liter (I)
1 Cubic foot (ft3) = 28.317 Liters (I)
1 Degree Fahrenheit (F) = (1.8 X C)+32
1 Inch Pound (in Ib) = 0.113 Newton Meters (Nm)
1 Foot Pound (ft Ib) = 1.356 Newton Meters (Nm)

Checklists (printable Sample)

PREFLIGHT CHECK LIST
1. Check aircraft papers-
   Aircraft Registration, Airworthiness Certificate,
   (POH) Flight Manual, Weight and Balance,
   & Operating Limitations
2. Check if logbooks are current
   and note latest maintenance performed.

PREFLIGHT INSPECTION
1. Control surface hinge bolts secure
2. Control linkage bolts secure
3. Rudder control cable wear and bolts secure
4. Propeller secure and free of nicks and damage
5. Exhaust system mounting secure
   Force side to side approx. 10 lbs. pressure
   Check for cracks and that all springs are safety'd
6. Rotary valve reservoir quantity check
   and check cap is secure
7. Coolant radiator mounting secure
   Check coolant quantity and secure
   Radiator cap carefully.
8. Engine mounting, Carb. mounting, Hoses,
   Fuel lines, cables and wiring secure.
9. If Solo check rear seatbelts secure.
10. Fuel quantity and fuel cap secure.
11. Remove tie-downs and chocks.

ENGINE START
1. Open fuel valve & Squeeze fuel bulb.
2. Prime 4 times
3. Open throttle slightly 1/4"
4. Master switch **"ON"**
5. Hold brakes
6. Look & Yell **"CLEAR PROP"**
7. Press Starter Switch to engage STARTER

BEFORE TAKEOFF
Engine Run-up
1. Ignition Mag. Check:
   Pointed into wind w/brakes ON.
   Engine 3500 RPM; 200 rpm max drop.
2. Engine Instrument check:
   Verify, RPM and EGT CHT are working
   Coolant temp is at least 140.
   Throttle back to smooth idle

BEFORE FLIGHT
1. Altimeter **SET**& Vario **ON** if equipped
2. Seatbelts-
3. Elevator trim set
4. Control check free movement to extremes
5. Fuel quantity check
6. Check traffic 90,180,360
7. Transmit intentions

ENGINE SHUTDOWN
1. Hold brakes
2. Radio, Vario, and Headsets **OFF**
3. Throttle back to low idle
4. Master switch **OFF**
5. Turn **ignition switches OFF**
6. Secure stick w/seatbelts
7. Secure plane w/tiedowns and chocks

NOTES:

This Checklist can be copied,
cut around outside border,
folded back in the middle,
then laminated, to carry on Aircraft

Appendix A1 EIS (582 only)

Model 2000G

ENGINE INFORMATION SYSTEM

With GPS Interface

Grand Rapids Technologies Incorporated
3133 Madison Ave SE
Grand Rapids, MI 49548
(616) 245-7700 Fax (616) 245-7707

Rev 07/31/01

Introduction - The Importance of the Engine Information System

Two-stroke engines are lightweight and powerful, making them ideally suited for ultralight aircraft. Their only potential weakness is their intolerance for operating outside their strict temperature limits. Exceeding these limits can cause engine damage in as little as tens of seconds. The EIS greatly overcomes this weakness by continuously monitoring all critical engine parameters, and alerting you with a bright red flashing light should damaging engine conditions develop. With this close monitoring it is nearly impossible to knowingly exceed these limits, making the two-stroke engine well suited as an ultralight aircraft engine.

Understanding EGT and CHT - Why they are critical to safe engine operation.

The need for monitoring engine RPM and coolant temperatures (water-cooled engines) is obvious to most pilots. The tachometer gives you a measure of the power being produced, and allows you to keep RPM within limits to prevent damage from mechanical stresses that result from high RPM. The coolant temperature allows detection of high engine temperatures that could result in thermally induced mechanical damage due to insufficient cooling. But often EGT and CHT measurements are often misunderstood. They perform very separate and distinct roles.

Why monitor Exhaust Gas Temperature (EGT)?

EGT reflects the ratio of fuel to air being provided to the cylinder. The leaner the mixture, the higher the EGT. EGT does not provide any indication of how well the engine is being cooled. (This is the job of coolant and CHT.)
Internal parts (such as the piston) of all two-stroke engines will be damaged if they are operated with an EGT that is too high. ***Damage can occur in a matter of tens of seconds or less if EGT limits are exceeded.***
What causes a high EGT?

A lean fuel/air mixture will cause high EGT. This can be caused by:

Misadjusted, or a problem with, the carburetor

Too little load on the engine, such as an under pitched propeller. (This also results in unusually high engine RPM).
A problem with fuel delivery to the engine, such as a clogged fuel line or filter, a malfunctioning fuel pump, etc.
Unbalanced (unequally opening) carburetors will cause one cylinder to operate with a higher EGT.
Cooler ambient temperatures and lower altitudes. An engine set up for operation in Denver (5000 feet above sea level) will operate at higher EGTs when operated at sea level.
What do you do when you get a high EGT alarm.

If possible, reduce engine power. If high EGTs persist, be prepared for the possibility of sudden engine stoppage!
If not possible to reduce power, try going to full power. The carburetor provides the leanest mixture (and highest EGTs) around mid power. Going to full power will normally reduce the EGTs, assuming the engine is otherwise functioning normally.

Why monitor Cylinder Head Temperature (CHT) and Coolant Temperature?

Both CHT and coolant temperature reflect how well the engine is being cooled.
They revel problems association with insufficient cooling, such as poor airflow over the engine and/or radiator, lack of coolant, loose fan belts, etc.
They do not provide any indication of the mixture being too lean, and thus can not give any warning about excessive internal engine temperatures. (This is the job of EGT.)
For air-cooled engines, CHT is the only means to measure how well the engine is being cooled.
For water-cooled engines, CHT allows detection of uneven coolant flow, and provides earlier warning to loss of coolant than water-temperature.
Exceeding these limit may result in damage, but not nearly as quickly as exceeding EGT limits.

What causes high CHT and Coolant Temperatures?

High power settings and high ambient temperatures.
Problems with the engine's cooling system.
What to do when you get a high CHT and/or Coolant alarm?

Reduce engine power as soon as practical.
Reduce the load on the engine by reducing the climb rate.
If normal temperatures can not be achieved with these actions, land as soon as practical and safe and investigate.
Can only EGT or CHT/Coolant Temperature be monitored?

No. Remember that EGT reflects the fuel/air ratio, and the internal temperatures of the engine. The CHT and coolant reflect how well the engine is being cooled, and the overall temperature of the engine. When an engine is damaged due to high EGT (lean mixture), it is typical for the CHT or coolant temperature to remain normal. When an engine is damaged due to high CHT and/or coolant (lack of cooling), it is typical for the EGT to remain normal. They measure different aspects of the engine that do not necessarily react together.

Operating Instructions for the EIS Model 2000G

The Model 2000 is specifically designed for the powered-parachute type aircraft, requires very little input from the pilot.

Before using the Model 2000 for the first time:

Set the units for temperature, altitude, and fuel quantity (if used) as desired. The instruments are set at the factory to Fahrenheit, Feet and Gallons for temperature, altitude, and fuel respectively.
Read the section on “Automatic Altimeter” operation. Set this as desired.
Engine limits are pre-set at the factory. You may review these limits, and change them at any time if you desire.
All settings in the instrument may be set back to the initial factory settings by holding the right button (“Display”) when turning on the instrument.

Before Each Flight:

1. If the altimeter is operated in the Manual mode, set the altimeter appropriately. If the altimeter is set to the automatic mode, no action is required.

Detailed Description of the Features:

Automatic/Manual Altimeter Setting.

The altimeter can be set manually by the pilot, or automatically the by the instrument. This option is selected on the "SET LIMITS" pages.

Automatic Altimeter Operation -

In this mode the altimeter will automatically be set to zero at 45 and 75 seconds after the instrument is turned on, if the engine is running and has not exceeded 4100 RPM. If the RPM goes above 4100, the instrument assumes the airplane is in the air, thus does not alter the altimeter setting.

The intent of this logic is to allow the instrument to automatically zero the altimeter when the engine is being warmed up on the ground, but hopefully not cause the instrument to reset the altimeter when the instrument is turned on and off in the air. The automatic mode of the altimeter should not be used when:

You wish to set the altimeter to the airport's elevation. This is often done when flying to another airport, especially when the airports are at different elevations.

If you anticipate turning off the instrument in flight, and then turning it back on when the engine RPM is below 4100. This could be the case when stopping the engine in flight, and restarting.

Manual Altimeter Operation –

Use the "SET LIMITS" pages to set the altimeter as desired.

Flight Timer

The flight timer shows you how long your flight has lasted. It resets at power up, and starts counting when the engine is running (based on the tachometer). It displays the previous flight time until the current flight time reaches 3 minutes, allowing you to easily recall the length of the previous flight. A warning can be set when the timer exceeds your preset limit to remind you to check your fuel.

Favorite Page

The instrument will automatically select your favorite page when the checklist is ended, or the right button is double-clicked, or when leaving the "Set Pages". Your favorite display page is entered under the "DISPLAY" setting in the "Set Limits" pages. It is the last setting on these pages.

Press-to-See Labels

Pressing the right button ("Display") when on a combination page (that is, a page with no labels), will replace the numeric data with labels to identify the data. Releasing the button returns the numeric data to the page.

Double-clicking the "Display" button immediately takes you to your favorite page. Normally a combination page is used as your favorite.

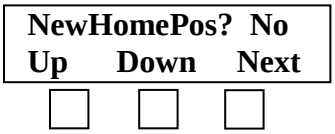
GPS Page

The GPS page gives you easy-to-read and easy-to-understand steering information to get you home. It also provides groundspeed, as well as the distance and magnetic bearing to home. This function requires the connection of a GPS to the EIS to perform these functions. Using the GPS page provided on the EIS has several advantages over that of a stand-alone GPS, namely:

Automatic Operation – A GPS requires the creation of a waypoint for each location you fly from, and also requires that you manually select the correct waypoint as the "Goto" in order to get steering information to it. The EIS does this automatically.
Large, Readable Display – The EIS display is much larger and more easily read than any of the low-cost GPS units available today.
Easy-to-Understand Steering – All handheld GPS receivers reviewed to date provide steering information that is sometimes invalid, and often hard to interpret. The EIS provides simple steering information, and provides it only when it is valid.
Convenient Grouping of Information – The GPS pages shows all relevant GPS data, as well as altitude and tachometer on one screen. (Although engine temperatures are not shown, they are being monitored by the EIS alarms.)

Saving your Home Position

At power-up, the EIS will determine if you are on the ground. If you are, and the GPS is providing data to the EIS, it will determine if you at the same location you flew from last time. If the EIS determines you are at a new location, it will prompt you to see if you would like to save this as your new home position. If you are at the same place you flew from your last flight, it will not issue this prompt.



If valid GPS position data is lost, the No/Yes prompt will be replaced with dashes, indicating no position is available for saving as your home position.

Normally, you will use the "Up" or "Down" button to select "Yes" and then press the right button to update your home position. Selecting "No" will retain the last home position, and is normally done only when on a cross-country flight. This page can also be manually accessed on the "Set Limits" pages, to allow you to save the current position as your home position at any time.

Note: The EIS assumes you are on the ground if the engine RPM has not exceeded 4100 RPM since the EIS was turned on, and the GPS indicates you are not moving.

Using the GPS Page

The GPS page is described in detail in figure 2. This page provide steering information to direct you to your home position, as well as RPM, altitude, groundspeed, distance and bearing to home. When data can not be calculated, or is unavailable, it will be replaced with dashes to indicate that no valid data is available.

Connecting a GPS and Setting up the GPS Function.

Only 2 electrical connections are required to a GPS. These are the serial data output line and ground. Refer to the "Cable Assembly" diagram for an illustration of how these connections are made.
Go to the "Configuration Set Pages" and make the following selections: (See the section "Configuration Set Pages" for more details on how this is done.)
GPS Page - ON
GPS Baud - 4800
GPS Units – Miles or Kilometers, as desired.

Turn on the GPS. Refer to its user's manual to select NMEA 0183 serial out on. Select a baud rate of 4800. If necessary, make any selection required to enable the GPRMC output sentence. (Most GPS receivers will transmit the GPRMC sentence automatically when the NMEA 0183 selection is made.)

Verify the EIS is receiving GPS data by checking the GPS page on the EIS. If data is being received, the "X" on this screen will disappear. When the GPS locks onto the satellites, a groundspeed of 0 will be displayed on the EIS. (Note: Magellan brand GPS receivers do not activate the data output until they have locked onto satellites and are able to provide a valid position. Garmin brand GPS receivers typically activate data output as soon as they are turned on, even before any position data is available.)

If no data is received by the EIS, double check your electrical connections, verify the GPS setup to transmit NMEA 0183 at 4800 baud, and verify the EIS is set to a baud rate of 4800. A fluctuating voltage of a couple of volts can be measured between the GPS serial output line and ground to verify it is providing data output.

Peak Recording

The EIS records the peaks (maximums) for 9 parameters during the flight. The recording of these items begins when 3 minutes has elapsed on the flight timer, at which time the peaks from the last flight are erased.

Since the peaks are recorded in non-volatile memory, the EIS is able to show you the peaks from the previous flight, even if the EIS has been turned off since the end of the last flight. (These peaks will not be erased until 3 minutes into the next flight.) This can be very useful for evaluating the highest RPM generated by your engine, peak engine temperatures, as well as your maximum altitude and your maximum distance from your home position.

The peaks that are recorded are as follows:

Tachometer
Cylinder Head Temperature #1 & #2
Exhaust Gas Temperature #1 & #2
Coolant Temperature
Voltmeter
Altimeter
GPS Range (from your home position)

To view the peaks, select the "Set Limits" pages, and page down to the "Show Peaks" page. Use the UP/DOWN to select "YES". Press and hold the right button to leave the set pages. The peak values for the above items will replace their current values on the various display pages. The EIS will alternately flash the symbol "PK" and the peak data to identify the peaks.

The "Show Peaks" function can be turned off by returning to the "Show Peaks" page and selecting "NO". This function is also automatically turned off at power-up, or whenever the RPM exceeds 4100. The "Show Peaks" function is disabled when the RPM is above 4100.

Warning System Operation

The alarm system is the most important part of the system. It allows you to enjoy flying without the need to constantly monitor your instrument. Damaging engine conditions are made immediately obvious.

All alarms cause the warning light to flash, and the page to change automatically to a labeled screen which includes the out-of-limit parameter. The offending parameter is flashed on the display, along with the warning light until the problem goes away, or until it is acknowledged by pressing the "Next/Ack" button. Acknowledged alarms cause the warning light to stay on steady until the condition ends, and does not inhibit other alarms.

Set Limit Pages

The settings on these pages are accessed by pressing the left and center buttons together. This will immediately bring up the set pages, displaying each item listed, one at a time. While on the set pages, the bottom row of the display will show "UP Down Next", indicating the function of the buttons while on these pages. As such, the left and center buttons allow you to change the setting, and the right button takes you to successive settings. To leave these pages, repeatedly press the right button, or press and hold the right button, until the normal display pages return. The items that can are set on these pages are, in order, as follows:

- **Contrast** defaults to the best setting at power-up. It may be altered if desired to enhance readability.
- **Alt-Set** allow you to select Auto or Manual for the altimeter setting function.
- **Alt** shows the current altimeter setting. Altitude is manually set here.
- **New Home Pos?** This setting is only available it the GPS page is turned on. Selecting "Yes" and pressing the right button stores the current position as your home position. Dashes will be displayed when no valid GPS position has been received in the last 60 seconds. **(Not Used)**
- **Show Peaks** allows you to display the peak values in place of the current values on the various display pages. This function is inhibited while the RPM is greater than 4100. See the "Show Peaks" section for more information. **(Set to NO)**
- **Max Timer** gives you the maximum time before the flight timer will issue an alarm. The limit is entered in minutes. If you exceed this limit, it can be increased easily in flight. **(Not Used)**
- **Max Cool** is the maximum coolant temperature. **(Set to 175 F or 80 C)**
- **Max RPM** is the maximum RPM. This limit is set in 30 RPM increments. **(Set to 6400)**
- **Min Fuel** applies to the optional fuel level input. **(Not Used)**
- **Max Volt** is used to warn of overcharging due to a failed regulator. A good limit for this is 15.0 volts. If a battery is not used, this alarm is not required. **Max Volt (Set to 15 volts)**
- **Min Volt** is used to warn of battery discharging. A good setting for this is 12.0 - 12.8 volts. **Min Volt (Set to 12 volts)**
- **Max EGT** is a very critical alarm, as high EGT can destroy an engine in seconds to minutes. It reflects the fuel/air mixture being burned by the engine. A typical limit is 1200-1250 degrees F. **Max EGT (Set to 1200 F or 650 C)**
- **Max CHT** warns of inadequate cooling. **Max CHT (Set to 300 F or 150 C)**
- **Display** is used to enter your favourite display page. **Display (Set to Page 4)**

Configuration Set Pages

These pages contain information that configures the instrument to your engine, and selects various options.. These pages are accessed by pressing and holding the **right** and center buttons for several seconds, until the bottom row of the screen displays "Up Down Next". While on the configuration set pages, the bottom row of the display will show "UP Down Next", indicating the function of the buttons while on these pages. As such, the left and center buttons allow you to change the setting, and the right button takes you to successive settings. To leave these pages, repeatedly press the right button, or press and hold the right button, until the normal display pages return. The items that can are set on these pages are, in order, as follows:

Fuel , Temp. and Altitude show the units they are using. The units for the vertical speed (climb rate) indicator are feet per minute (in increment of 100 feet per minute), or meters per second, corresponding to the selection for the altimeter.

GPS_Page – When "On" enables the GPS page. This page appears after the second combination page. See the section "GPS Page" for a complete description.

GPS_Units – Selects whether miles or kilometers will be used as the units on the GPS pages. Has no effect if GPS_Page is off.

GPS_Baud – Selects the baud rate for receiving data from the GPS. Most GPS receivers transmit data at 4800 baud, and this setting should be used.

EGT_Toggle – When "Off", the highest EGT is displayed on combination screen 1. When "On", this display will toggle between the two EGTs every 2 seconds, allowing you to observed both EGTs without switching pages.

CHT_Toggle – When "Off", the highest CHT is displayed on combination screen 1. When "On", this display will toggle between the two CHTs every 2 seconds, allowing you to observed both CHTs without switching pages.

Combo_Page – Selects whether coolant temperature (Cool) or outside air temperature (OAT) is displayed on the combination pages. The OAT selection is useful when coolant temperature is not being monitored.

TachP/R - Indicates the number of pulses per revolution of the engine for tachometer sensing. Rotax CDI engines require a setting of 6. The Rotax 912 requires a setting of 1.
Fuel-SF, Fuel-Off, FuelSens - Fuel level input scaling. Normal settings are 5, 0, and Forward, respectively. When using a Princeton Electronics fuel level probe, set the Fuel-SF to half of the desired full tank reading. (For example, if you want to display the fuel level as 0-100%, set the Fuel-SF to 50).
Messages at Power-Up
Non Rotax-Tach Setting – This indicates the TachP/R setting is not standard for a Rotax engine. This is a reminder that it may be set wrong. The instrument will not change the TachP/R setting however.
Limits Reset! – This indicates that a limit may have been altered unintentionally. The instrument will reset all limits the initial factory setting.

Troubleshooting Common Problems

Last printed 12/1/2014 8:58:00 PM

One EGT or CHT is erratic.	One of the two wires is unconnected between the instrument and the probe. Most commonly, a crimp connection on the quick disconnect on the probe, or the cable it plugs into, is loose. A visual inspection will usually be enough to find the problem. Another simple test is to use a continuity tester, and verify each pin at the instrument end of the cable has good continuity to the engine case, since each probe is grounded to the engine. The pins numbers are listed on the wiring diagram in the back of this manual.
All EGT and CHT are erratic.	This is caused by an open ground connection to the case of the engine on engines which do not include an electric starter.
Coolant Temperature shows 59 deg F all the time.	The connection to the coolant temperature probe is open, or the case of the coolant temperature sensor is not grounded. A quick test is to touch the coolant temperature sensor lead to ground. If the EIS show a high temperature, the connection to the instrument is good. If it does not change, check the wire between the instrument, and the coolant temperature sensor, especially the crimp on the quick-disconnect that plugs onto the coolant temperature sensor.
Tach Reading is erratic or zero when one mag is turned off.	This is normal, as the tach signal is generated by one of the mags. Sometimes it is possible to get a good reading if the mag test is performed at higher RPM (3500 or so).
Tach reading is steady, but too low or too high.	TachP/R is incorrectly set. See "Configuration Set Pages" section.
Instrument turns off by itself.	The battery or capacitor is not connected to the output of the regulator/rectifier. (Does not apply to Key West regulator/rectifiers.)

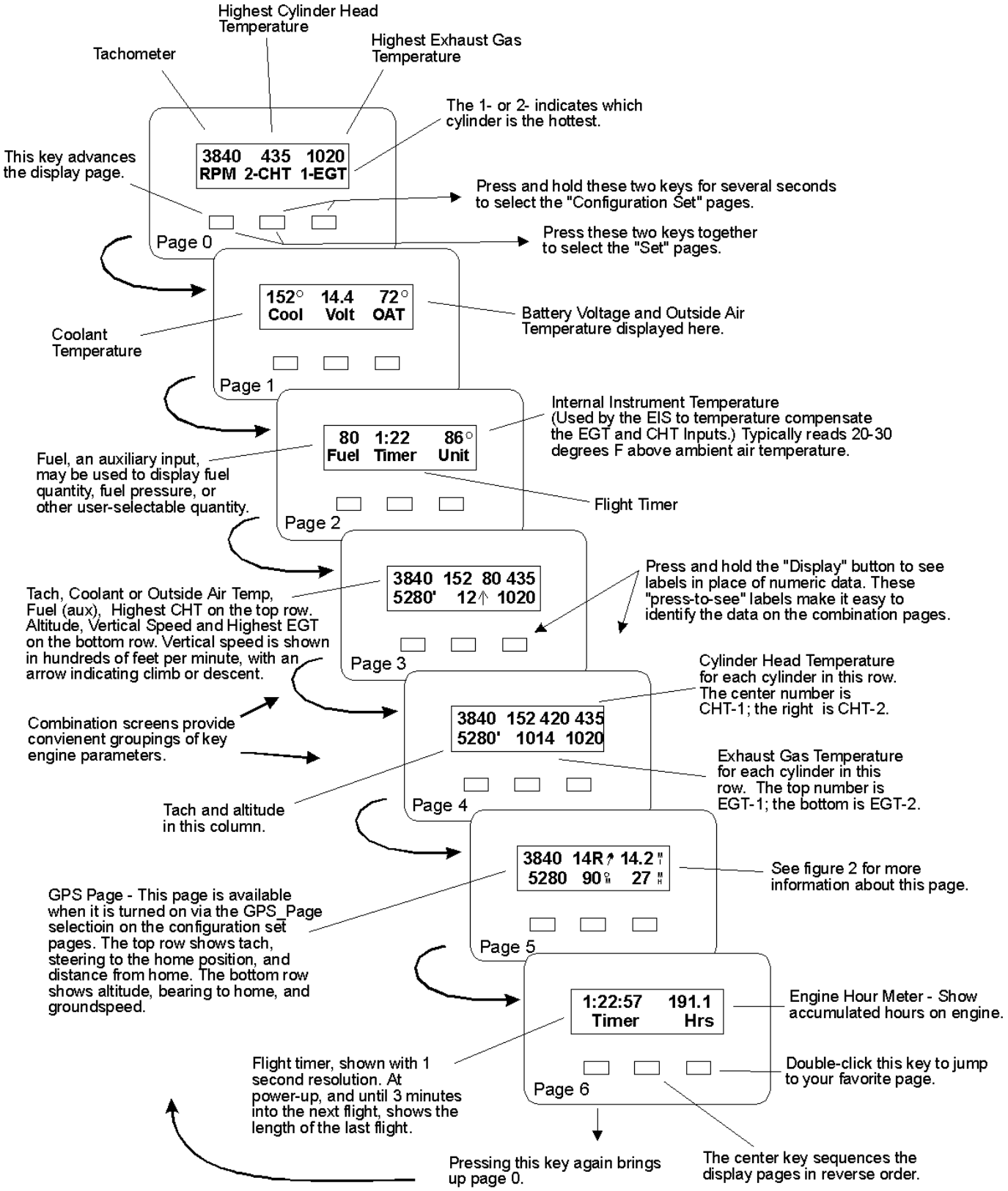
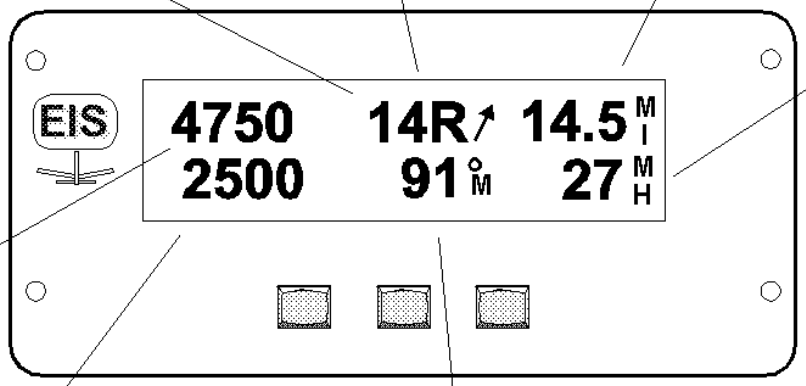

Highest Cylinder Head Temperature
Tachometer
Highest Exhaust Gas Temperature
The 1- or 2- indicates which cylinder is the hottest.
3840 435 1020
RPM 2-CHT 1-EGT
This key advances the display page.
Press and hold these two keys for several seconds to select the "Configuration Set" pages.
Press these two keys together to select the "Set" pages.
Page 0
152° 14.4 72°
Cool Volt OAT
Coolant Temperature
Battery Voltage and Outside Air Temperature displayed here.
Page 1
Internal Instrument Temperature (Used by the EIS to temperature compensate the EGT and CHT Inputs.) Typically reads 20-30 degrees F above ambient air temperature.
80 1:22 86°
Fuel Timer Unit
Fuel, an auxiliary input, may be used to display fuel quantity, fuel pressure, or other user-selectable quantity.
Flight Timer
Page 2
3840 152 80 435
5280' 12↑ 1020
Press and hold the "Display" button to see labels in place of numeric data. These "press-to-see" labels make it easy to identify the data on the combination pages.
Tach, Coolant or Outside Air Temp, Fuel (aux), Highest CHT on the top row. Altitude, Vertical Speed and Highest EGT on the bottom row. Vertical speed is shown in hundreds of feet per minute, with an arrow indicating climb or descent.
Page 3
Cylinder Head Temperature for each cylinder in this row. The center number is CHT-1; the right is CHT-2.
Combination screens provide convienent groupings of key engine parameters.
3840 152 420 435
5280' 1014 1020
Exhaust Gas Temperature for each cylinder in this row. The top number is EGT-1; the bottom is EGT-2.
Tach and altitude in this column.
Page 4
3840 14R 14.2
5280 90 27
See figure 2 for more information about this page.
GPS Page - This page is available when it is turned on via the GPS_Page selectioin on the configuration set pages. The top row shows tach, steering to the home position, and distance from home. The bottom row shows altitude, bearing to home, and groundspeed.
Page 5
1:22:57 191.1
Timer Hrs
Engine Hour Meter - Show accumulated hours on engine.
Flight timer, shown with 1 second resolution. At power-up, and until 3 minutes into the next flight, shows the length of the last flight.
Double-click this key to jump to your favorite page.
Page 6
Pressing this key again brings up page 0.
The center key sequences the display pages in reverse order.

Figure 1. Display Pages for the Model 2000G

Steering data updates with every update of data from the GPS. Some GPS receivers, especially older ones, may update data more slowly, especially when turning, making the steering data slow to change in response to your turns. To overcome this problem, **make an approximate turn according to the steering data, and then fly straight until the steering data stabilizes, before turning again.**

Steering - The 14R indicates a 14 degree turn to the **right** is required to put you on course. This steering automatically accounts for the effect of wind. The arrow give you a graphic indication of the direction of turn required to get on course. Dashes will replace this data when steering data is unavailable, such as when 500 feet friom home, or when home is over 200 miles away, or when your groundspeed is below 3 mph.

Distance to home - The distance in miles (as shown by the MI symbol), or kilometers (as shown by a KM symbol) from your current position to the saved home position. Dashes will replace this data if unavailable or when over 200 miles from home..



Groundspeed - This includes the effects of wind. It is displayed in miles/hour (MH symbol), or kilometers/hour (KH symbol). Determine your groundspeed in still air, and use the difference from this speed to determine the headwind component. This can be very useful for detecting winds which may be too strong to allow you to make it home! Remember that wind speed can vary greatly with altitude.

Tachometer

Altitude

How to use this page to get home.
Simple...follow the steering data. That is all there is to it...almost! There are 2 speical conditions you should be aware of.

Number 1. If the winds reduce your groundspeed less than 3 mph, the GPS can not determine your direction of travel over the ground . As a result, no steering data can be provided, and the EIS will display dashes, indicating no steering data is available. (Caution: Most GPS receivers tested to date will provide steering data on their display during this condition, even though it is invalid!)

Number 2. This is a tricky one! If strong winds cause you to travel backwards, it is impossible for the EIS or GPS to determine this is happening, and steering from both of these devices will be incorrect, even though there is no indication it is incorrect!. In this case you may notice that no matter what you do, it is impossible to get on course using the steerng data.

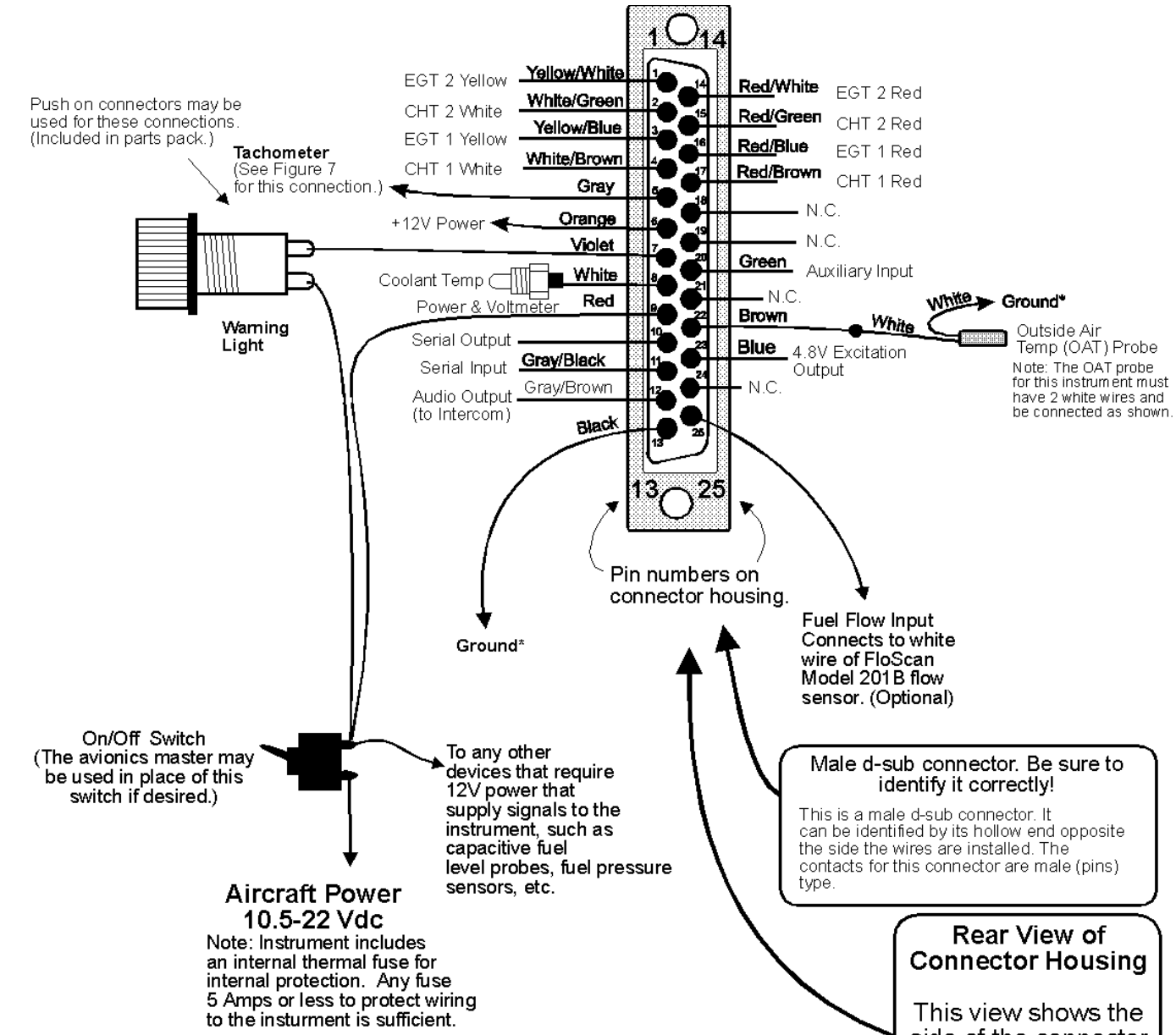
Bearing to home - This is the direction to home. Zero degrees represents due North, 90 degrees is due east, 180 is due south, and 270 is due west. In this example, home is almost exactly east of your current position. When the GPS is providing magnetic variation data, the bearing will be displayed as magnetic (referenced to magnetic north), and an "M" will be displayed below the degree symbol. If magnetic variation is unavailable, true bearings will be provided, and a "T" will be displayed below the degree symbol.

What good is bearing? Its best use is with the distance data as a rough check to verify the home positon the EIS is steering you to is correct. In this case, the EIS has a home position that is almost due east of the airplanes current position, and 14.5 miles away. Is this reasonable? You decide! Note that bearing data should not be used for steering.

Where is the home position?
This is the where the GPS was reporting you were at the last time you answered the "SaveHomePos?" prompt with "Yes".

At power-up, the EIS will prompt you automatically if you if you are at a new home position and the EIS determines you are on the ground not moving. You may also access the "SaveHomePos?" page on the set pages at any time. Selecting "Yes" will update your home position to the current position, so think twice before doing this while in flight!

Figure 2 - Using the GPS Page


Push on connectors may be used for these connections. (Included in parts pack.)
Tachometer (See Figure 7 for this connection.)
Warning Light
EGT 2 Yellow
CHT 2 White
EGT 1 Yellow
CHT 1 White
Yellow/White
White/Green
Yellow/Blue
White/Brown
Gray
+12V Power
Orange
Violet
Coolant Temp
White
Power & Voltmeter
Red
Serial Output
Serial Input
Gray/Black
Audio Output (to Intercom)
Gray/Brown
Black
Red/White
Red/Green
Red/Blue
Red/Brown
EGT 2 Red
CHT 2 Red
EGT 1 Red
CHT 1 Red
N.C.
N.C.
Green
Auxiliary Input
N.C.
Brown
Blue
4.8V Excitation Output
N.C.
White
Ground*
White
Outside Air Temp (OAT) Probe
Note: The OAT probe for this instrument must have 2 white wires and be connected as shown.
1
14
13
25
Pin numbers on connector housing.
Ground*
Fuel Flow Input Connects to white wire of FloScan Model 201B flow sensor. (Optional)
On/Off Switch (The avionics master may be used in place of this switch if desired.)
To any other devices that require 12V power that supply signals to the instrument, such as capacitive fuel level probes, fuel pressure sensors, etc.
Aircraft Power 10.5-22 Vdc
Note: Instrument includes an internal thermal fuse for internal protection. Any fuse 5 Amps or less to protect wiring to the insturment is sufficient.
Male d-sub connector. Be sure to identify it correctly!
This is a male d-sub connector. It can be identified by its hollow end opposite the side the wires are installed. The contacts for this connector are male (pins) type.
Rear View of Connector Housing
This view shows the side of the connector housing that the wire are inserted into.

Notes:

* To allow the most accuracy, this ground connection should be made at the same point where the instrument is ground wire is connected.

** The coolant temperature sensor has a round "hat". A 1/4" female quick disconnect pushes on over this hat to make the electrical connection.

4.8V Sensor Excitation Output- Required for some uses of the auxiliary inputs.

The serial input and output connections are left open (not connected). For the Model 2000G only, the serial input may be connected to the GPS serial data output to enable the GPS interface functions.

N.C. indicates No Connection. Do not wire to these inputs. They are reserved for future growth.

fig5-2se.cdr
rev F

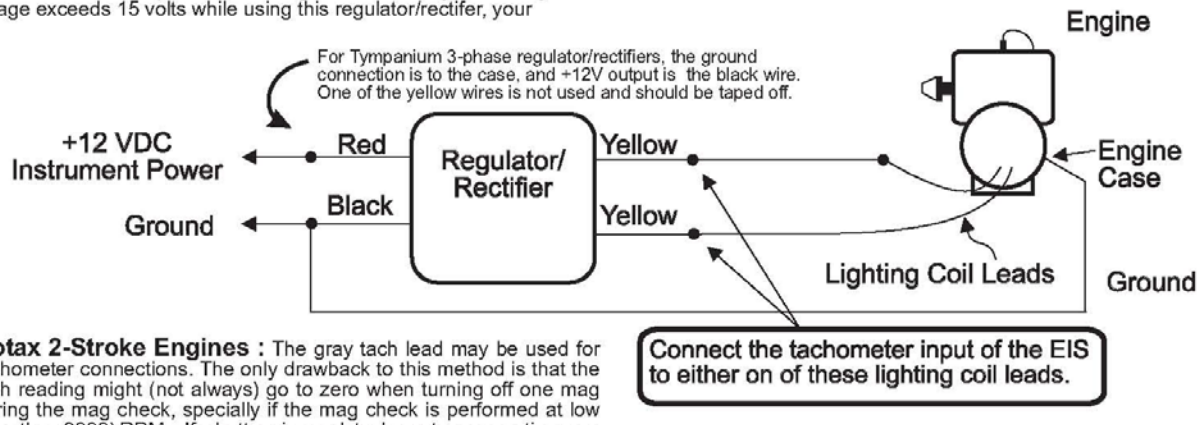
Figure 5 -- Connector A Wiring - Model 2000 for 2-Stroke engines - (Ext CJ)

Rotax (Tympanium) Regulator/Rectifiers -- (Also applies to Jabiru, HKS, and most others not otherwise listed.) Only one of the two inputs to the regulator/rectifier will give a good tachometer reading. The incorrect lead will give a tachometer reading that decreses with engine rpm. The correct lead must be determined by trial and error.

The small Tympanium regulator rectifier (identifed by its 2 yellow, 1 red and 1 black wires) often overcharges batteries. If your battery voltage exceeds 15 volts while using this regulator/rectifer, your

Making the tachometer connection is dependant on the type of

Key West Regulator/Rectifier. The gray tachometer lead must be used. The lighting coil wires may not be used as a tachometer soure with this regulator/rectifier.


Engine
For Tympanium 3-phase regulator/rectifiers, the ground connection is to the case, and +12V output is the black wire. One of the yellow wires is not used and should be taped off.
+12 VDC Instrument Power
Red
Regulator/ Rectifier
Yellow
Engine Case
Black
Yellow
Ground
Lighting Coil Leads
Ground
Connect the tachometer input of the EIS to either on of these lighting coil leads.

Rotax 2-Stroke Engines : The gray tach lead may be used for tachometer connections. The only drawback to this method is that the tach reading might (not always) go to zero when turning off one mag during the mag check, specially if the mag check is performed at low (less than 3000) RPM. . If a battery is used, tachometer connection may be made to the lighting coil as shown above to avoid loss of the tach reading during the mag check.

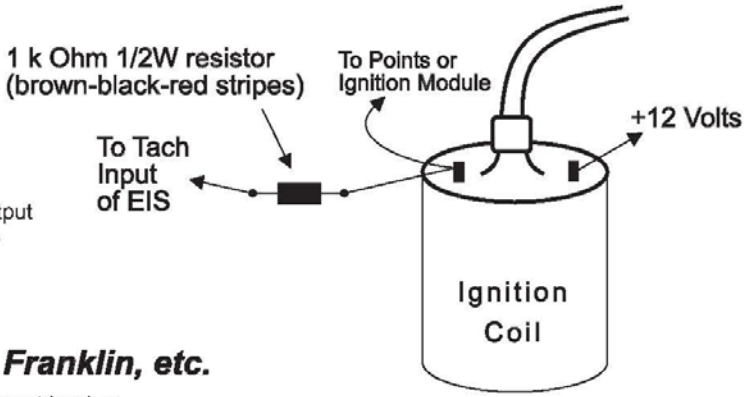
Figure 7a. Tachometer Connections to Lighting Coil Equipped Engines (Rotax, Jabiru, Hirth, Zenoah, etc.)

Electronic Ignition

Connect directly to the tach output from the igntion system. No resistor required.

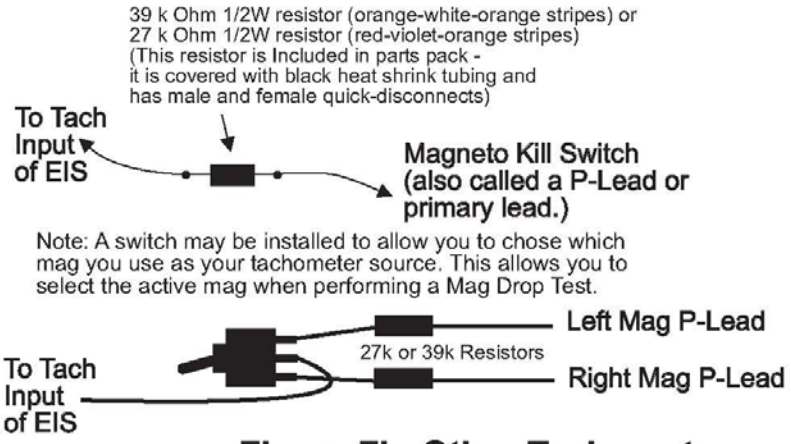
Rotax 912/914

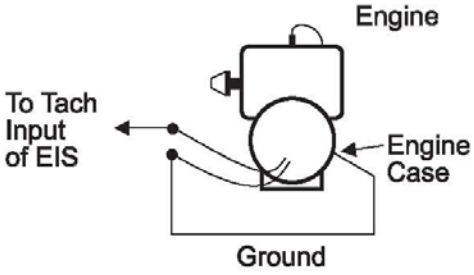
Connect tach input to one of the two tachometer output wires. Connect the other tach output wire to ground.



Point-Type Ignition

Magneto Equipped Engines such as Lycoming/Continental, Franklin, etc.


39 k Ohm 1/2W resistor (orange-white-orange stripes) or
27 k Ohm 1/2W resistor (red-violet-orange stripes)
(This resistor is Included in parts pack - it is covered with black heat shrink tubing and has male and female quick-disconnects)
To Tach Input of EIS
Magneto Kill Switch (also called a P-Lead or primary lead.)
Note: A switch may be installed to allow you to chose which mag you use as your tachometer source. This allows you to select the active mag when performing a Mag Drop Test.
Left Mag P-Lead
27k or 39k Resistors
To Tach Input of EIS
Right Mag P-Lead



Spare Lighting Coil

Figure 7b. Other Tachometer Connections (Model 2000/4000/6000 EIS)

tach.cdr Rev C

End of Appendix A1 EIS 2000 Manual in POH

Model 4000/6000
ENGINE INFORMATION SYSTEM
User's Manual

Grand Rapids Technologies Incorporated
3133 Madison Ave SE
Grand Rapids, MI 49548
(616) 245-7700 Fax (616) 245-7707

Rev L
Applicable to Software Versions 7.5 and above.

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Serial Number_____

Model Number _____

Options _____

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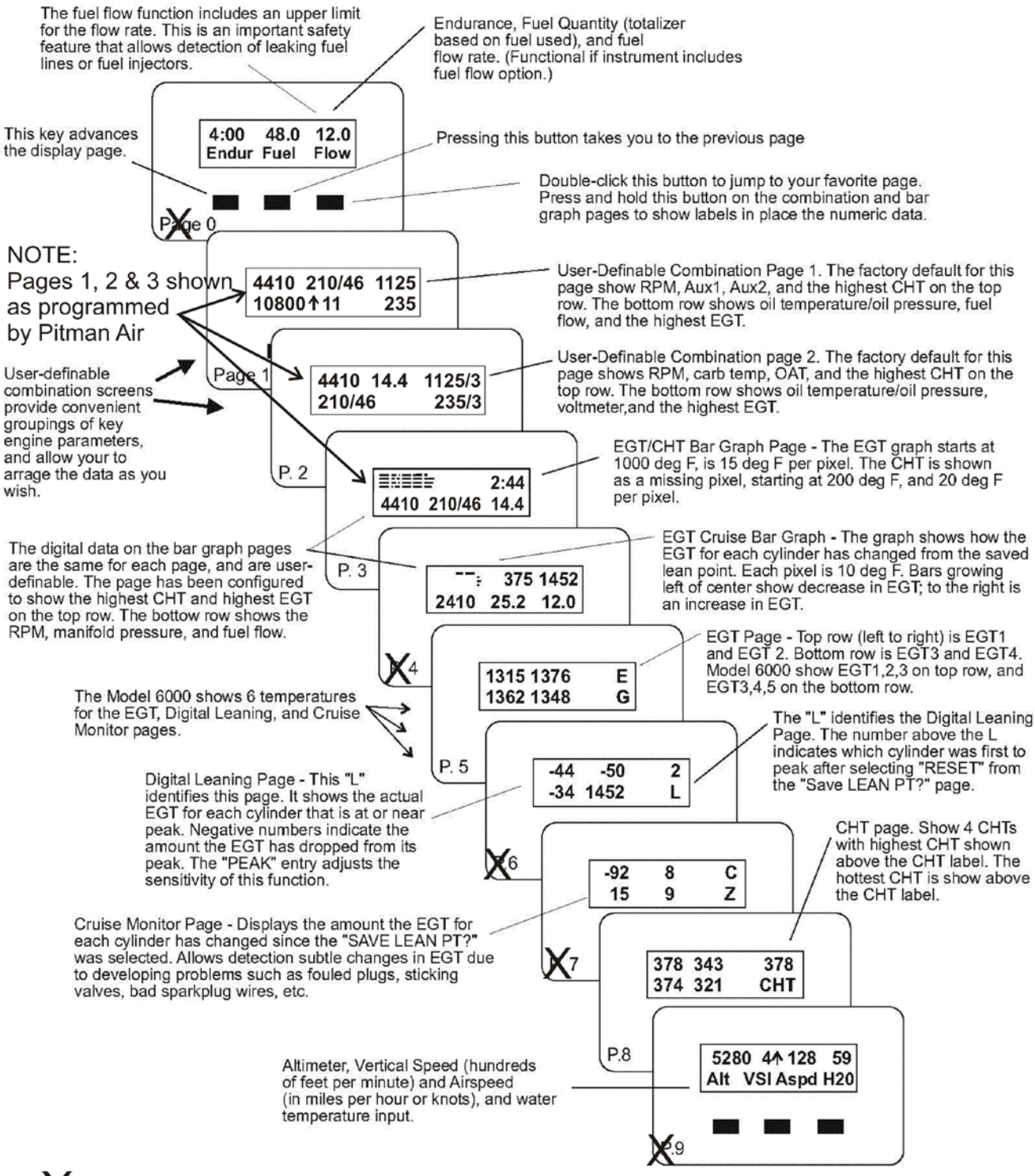
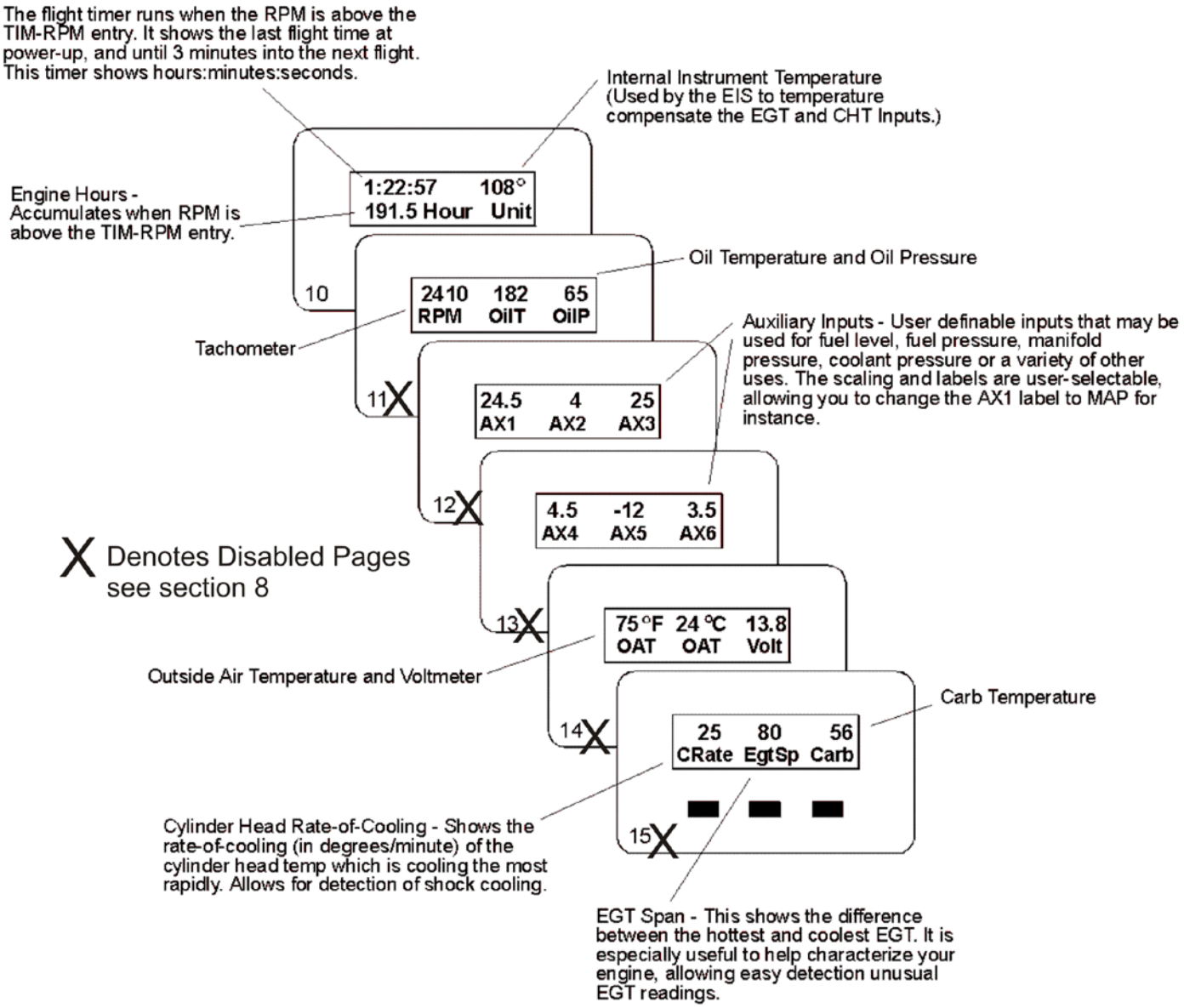

The fuel flow function includes an upper limit for the flow rate. This is an important safety feature that allows detection of leaking fuel lines or fuel injectors.
Endurance, Fuel Quantity (totalizer based on fuel used), and fuel flow rate. (Functional if instrument includes fuel flow option.)
This key advances the display page.
4:00 48.0 12.0
Endur Fuel Flow
Pressing this button takes you to the previous page
Double-click this button to jump to your favorite page. Press and hold this button on the combination and bar graph pages to show labels in place the numeric data.
Page 0
NOTE:
Pages 1, 2 & 3 shown as programmed by Pitman Air
4410 210/46 1125
10800↑11 235
User-Definable Combination Page 1. The factory default for this page show RPM, Aux1, Aux2, and the highest CHT on the top row. The bottom row shows oil temperature/oil pressure, fuel flow, and the highest EGT.
User-definable combination screens provide convenient groupings of key engine parameters, and allow your to arrage the data as you wish.
Page 1
4410 14.4 1125/3
210/46 235/3
User-Definable Combination page 2. The factory default for this page shows RPM, carb temp, OAT, and the highest CHT on the top row. The bottom row shows oil temperature/oil pressure, voltmeter,and the highest EGT.
P. 2
2:44
4410 210/46 14.4
EGT/CHT Bar Graph Page - The EGT graph starts at 1000 deg F, is 15 deg F per pixel. The CHT is shown as a missing pixel, starting at 200 deg F, and 20 deg F per pixel.
The digital data on the bar graph pages are the same for each page, and are user-definable. The page has been configured to show the highest CHT and highest EGT on the top row. The bottow row shows the RPM, manifold pressure, and fuel flow.
P. 3
375 1452
2410 25.2 12.0
EGT Cruise Bar Graph - The graph shows how the EGT for each cylinder has changed from the saved lean point. Each pixel is 10 deg F. Bars growing left of center show decrease in EGT; to the right is an increase in EGT.
P. 4
1315 1376 E
1362 1348 G
EGT Page - Top row (left to right) is EGT1 and EGT 2. Bottom row is EGT3 and EGT4. Model 6000 show EGT1,2,3 on top row, and EGT3,4,5 on the bottom row.
The Model 6000 shows 6 temperatures for the EGT, Digital Leaning, and Cruise Monitor pages.
The "L" identifies the Digital Leaning Page. The number above the L indicates which cylinder was first to peak after selecting "RESET" from the "Save LEAN PT?" page.
P. 5
-44 -50 2
-34 1452 L
Digital Leaning Page - This "L" identifies this page. It shows the actual EGT for each cylinder that is at or near peak. Negative numbers indicate the amount the EGT has dropped from its peak. The "PEAK" entry adjusts the sensitivity of this function.
CHT page. Show 4 CHTs with highest CHT shown above the CHT label. The hottest CHT is show above the CHT label.
P.6
-92 8 C
15 9 Z
Cruise Monitor Page - Displays the amount the EGT for each cylinder has changed since the "SAVE LEAN PT?" was selected. Allows detection subtle changes in EGT due to developing problems such as fouled plugs, sticking valves, bad sparkplug wires, etc.
P.7
378 343 378
374 321 CHT
P.8
5280 4↑128 59
Alt VSI Aspd H20
Altimeter, Vertical Speed (hundreds of feet per minute) and Airspeed (in miles per hour or knots), and water temperature input.
P.9
X Denotes Disabled Pages see section 8

Figure 1a. Model 4000 and 6000 Display Pages

Figure 1a - Description of Pages


The flight timer runs when the RPM is above the TIM-RPM entry. It shows the last flight time at power-up, and until 3 minutes into the next flight. This timer shows hours:minutes:seconds.
Internal Instrument Temperature (Used by the EIS to temperature compensate the EGT and CHT Inputs.)
1:22:57 108°
191.5 Hour Unit
Engine Hours - Accumulates when RPM is above the TIM-RPM entry.
Oil Temperature and Oil Pressure
10
2410 182 65
RPM OilT OilP
Tachometer
Auxiliary Inputs - User definable inputs that may be used for fuel level, fuel pressure, manifold pressure, coolant pressure or a variety of other uses. The scaling and labels are user-selectable, allowing you to change the AX1 label to MAP for instance.
11X
24.5 4 25
AX1 AX2 AX3
12X
4.5 -12 3.5
AX4 AX5 AX6
X Denotes Disabled Pages see section 8
13X
75°F 24°C 13.8
OAT OAT Volt
Outside Air Temperature and Voltmeter
Carb Temperature
14X
25 80 56
CRate EgtSp Carb
15X
Cylinder Head Rate-of-Cooling - Shows the rate-of-cooling (in degrees/minute) of the cylinder head temp which is cooling the most rapidly. Allows for detection of shock cooling.
EGT Span - This shows the difference between the hottest and coolest EGT. It is especially useful to help characterize your engine, allowing easy detection unusual EGT readings.

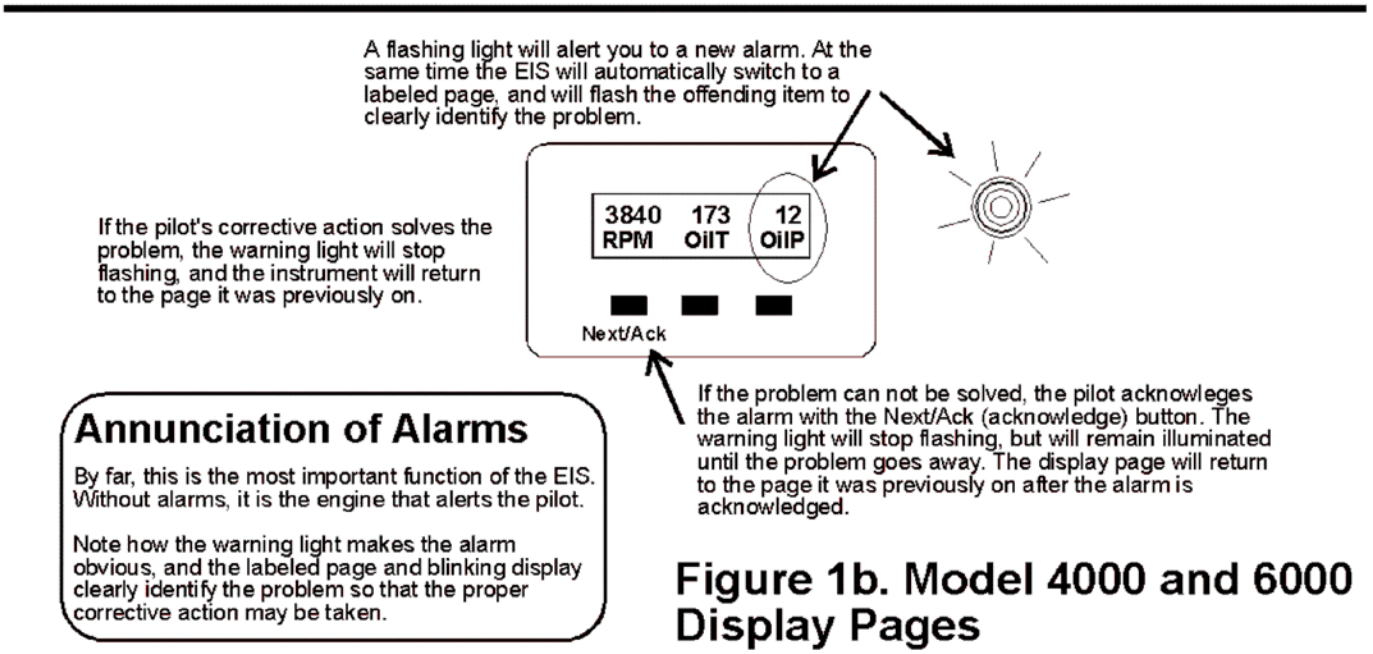

A flashing light will alert you to a new alarm. At the same time the EIS will automatically switch to a labeled page, and will flash the offending item to clearly identify the problem.
If the pilot's corrective action solves the problem, the warning light will stop flashing, and the instrument will return to the page it was previously on.
3840 173 12
RPM OilT OilP
Next/Ack
If the problem can not be solved, the pilot acknowleges the alarm with the Next/Ack (acknowledge) button. The warning light will stop flashing, but will remain illuminated until the problem goes away. The display page will return to the page it was previously on after the alarm is acknowledged.
Annunciation of Alarms
By far, this is the most important function of the EIS. Without alarms, it is the engine that alerts the pilot.
Note how the warning light makes the alarm obvious, and the labeled page and blinking display clearly identify the problem so that the proper corrective action may be taken.

Figure 1b. Model 4000 and 6000 Display Pages

Figure 2. Operation

Congratulations on your purchase of Grand Rapids Technologies' Engine Information System (EIS). We are pleased that you have chosen our product to meet your aircraft instrumentation needs. You will find this system will enhance your flying pleasure while increasing your level of safety.

1. Read This First!

Note for those upgrading the software with a new computer chip. After installing the chip, it may be initialized to factory default settings by pressing and holding the right button when turning the instrument on. After a delay of a few seconds, this will set the user-defined pages to the factory configuration.

Advice Before Starting Your Installation: Three steps to make your installation easier.

Step 1. Determine how you would like to arrange your EGT/CHT connections. The EGT/CHT inputs are numbered 1-4 (1-6 for the Model 6000). You may simply connect EGT1 & CHT1 to cylinder number one (according to the engine manufacturer's cylinder numbering). This is common, and works well. For four-cylinder engines there is also an alternate method. You may wish to connect the EGTs and CHTs so they correspond to their position on the digital display pages. That is, connecting EGT 1 & CHT 1 to the front left cylinder (since it appear on the top left position of display page), EGT 2 & CHT 2 to the front right cylinder (since it appears on the top right position of the display page), and so on. (Figure 1 illustrates the position of the data on the display pages.) Either option works well, although personally the latter method is easiest. The main point is to make sure you know which cylinder corresponds to each of the readings on the instrument so that you will perform maintenance on the correct cylinder when it becomes necessary.

Step 2. Plan which functions you will wire to each of the 4 auxiliary inputs. Recall that manifold pressure, fuel pressure, fuel level, vacuum, coolant pressure (and any others that do not have a dedicated input to the instrument) must be connected through the auxiliary inputs. (The auxiliary inputs may be used for other functions also, but these are the most common uses.) The only significant consideration concerns the position of the auxiliary input functions on the labeled pages. Referring to figure 1b, you will note that auxiliary 1, 2, & 3 appear on page 12, and auxiliary 4 appears on the next page. You may prefer to see two or three auxiliary functions on the same page (for example, left and right fuel levels). This will require wiring them to the first three auxiliary inputs.

Step 3. Remember that you have complete control over what will be displayed on the two combination pages, and the digital data displayed on the bar graph pages. You will find this useful for conveniently displaying the exact data you would like available during your flight

…now on to the installation!

2. An Overview of Installation & Setup

Installation of the EIS includes the physical mounting of the instrument into the airplane's instrument panel, making the electrical connections from the pre-wired cables to the various sensors, and finally setting entries in the instrument to customize your instrument for your installation. The first two steps are quite obvious. The entries made to the instrument for your installation tells the instrument such things as how many pulses per revolution of your engine, units (Fahrenheit or Celsius), etc.

Following these steps, operation of the instrument will be verified by applying power to it. Finally, you will set your engine limits, and customize the display pages to your liking.

During flight you will use the leaning functions to accurately lean your engine. During the cruise portion of your flight you will use the tracking functions to continuously monitor your engine for even momentary signs of developing engine problems. Now let's get started with the installation by turning to the section "Installation" which begins on page 54

3. Using the Engine Information System

Refer to figure 1 for a description of the various display pages, and to figure 2 for an illustration of the use of the EIS from panel keys to control the operation of the instrument.

3.1 The Basics of the Engine Information System Operation

Power to EIS when starting the engine. It is good practice to turn on the EIS before starting the engine, and verify a low oil pressure warning is generated. This verifies the oil pressure sensor is able to sense zero pressure correctly. The instrument may be left on, and the engine started, at which time the warning light should go off, indicating oil pressure is within limits. While the oil pressure sensor is very reliable, this procedure is recommended because it requires little more than turning the instrument on before starting your engine.

The Display button and your favorite page. Double-clicking the "Display" key will immediately change screens to the page you have selected as your favorite display page. This provides a quick and simple means of returning your instrument to your favorite page, after you have been reviewing other display pages. To make your selection of which page is to be displayed by the "Display" key, see the "Set Pages" section.

The Display button and On-Screen Labels. Pressing and holding the "Display" button while on a user-configurable page (a combination page or bar-graph page) will replace the numeric data with labels, making it easy to identify the data on the screen. Releasing the button returns the display to numeric data.

The Alarms – The most important part! The instrument's alarm function will alert you to out-of-limit conditions by flashing the warning light (to get your attention), and simultaneously changing pages to a labeled screen and flashing the reading above its label to identify it. If the problem can not be fixed immediately, the alarm should be acknowledged by pressing the "Next/Ack" button on the EIS. (When the alarm light is flashing, the instrument will ignore the other buttons.) Acknowledging an alarm returns the instrument to the page it was previously on, and allows it to alert you to the next problem. After acknowledging an alarm, the warning light will remain continuously on as long as any out-of-limit condition exists. The warning light will go out when everything is within limits. An alarm that goes away, and then returns, is treated as a new warning, and will again generate the response described here. Multiple alarms are presented according to priority, one at a time.

Determining Alarm Status – After acknowledging one or more alarms, the warning light will stay continuously on indicating as long as one or more functions are out-of-limits. To make the instrument to show you the current out-of-limit conditions, select the "Set Pages", then simply hold the right button depressed until the instrument returns to the normal display pages. Upon leaving the set pages, the instrument will clear the acknowledgement of all alarms, causing it to re-annunciate all current alarm conditions as if they were new alarms. Turning the power of and back on will also accomplish this action, but will reset the flight timer.

Set Unused Limits to Zero. By setting a limit to zero, the alarm function for that limit will be turned off. It is a good idea to set limits for all unused functions to zero so that the instrument does not inadvertently generate nuisance warnings for signals you are not using.

3.2 Before Each Flight

1) If the instrument includes the altimeter option, set it before each flight.
2) If the instrument includes the fuel flow option, review or update the fuel quantity setting as necessary. (Pressing the outer two buttons of the EIS will bring up the fuel quantity set page. While on this page, pressing the "UP" and "DOWN" (left and center buttons) will set the fuel quantity to whatever you have entered on the "MAX Fuel" setting on the configuration set pages.)

All engine limits are stored with a checksum. If the instrument determines a user setting has been lost, it will generate a "Check Entries" message at power-up. If you see this message, carefully review all user settings.

At power-up, the EIS will automatically select the page you have set as your favorite in the "DISPLAY" set page. If an alarm is active, the instrument will first annunciate the alarms (requiring you to press the right button to acknowledge them) before going to your favorite page.

Suggestion! Include in your checklist a step to turn on the instrument before starting the engine. Verify you get a low oil pressure warning (and possibly others). This is a simple way of verifying the oil pressure sensor is correctly measuring zero oil pressure. This is recommended not because the sensor is prone to failure (it is actually very reliable), but because it is a very easy test to verify the most critical engine monitoring function.

NOTE: It is possible for the instrument or its sensors to suffer various kinds of failures that can not be detected by the self-test. It is good practice to review the various display pages periodically as necessary to verify that the instrument and its sensors are operating normally.

4. SET PAGES – Setting Engine Limits and other User Entries

The “Set" pages are used to enter engine limits and other selections into the EIS. These pages are accessed by simultaneously pressing the two keys marked “SET LIMITS", as illustrated in figure 2. The use of the engine limits, and the other features controlled on these pages, are described below. All entries on these pages are retained when the instrument is turned off. No electrical connection to the instrument, or battery is required to maintain these settings.

Since all limits can be entered easily by the pilot at any time, it is practical to set engine limits lower than those indicated by the engine manufacturer, but slightly higher than encountered in normal operation. In this way, a change in normal engine operation may be detected earlier.

Minimum and maximum limits are included for most functions, even when some of the limits may have no everyday practical use. This allows additional flexibility to assist with engine troubleshooting, especially to help alert you to intermittent problems that would otherwise be hard to detect.

All limits must be set in the same units selected on the “UNITS” page. If you change the units (from Fahrenheit to Celsius for example), the limits will not change, making all temperature limits incorrect unless reset to Celsius.

NOTE: Limits that are not used should be set to zero. This disables the limit to prevent nuisance false warnings. Some limits may not have a practical use for routine flying, but have been included to provide additional flexibility in diagnosing engine problems. Normally these limits are set to zero.

CAUTION: While the “Set" pages are selected, the automatic warning feature of the instrument is disabled. This is necessary to allow the pilot the ability to change an engine limit in the presence of an engine parameter that is intermittently outside of its limit. The warning light is illuminated while the “Set Limits” pages are selected to remind you that the warning feature has been disabled---and as a convenient means of testing this light.

All alarms will be annunciated as described in “Using the Engine Information System”, unless otherwise noted in the table below.

4.1 Set Page Table of Limits. [Brackets denote Dragonfly Factory Settings] N/U = not used

Setting	Use	Recommended Setting
Cont **[2 or 3]**	Contrast - Adjusts screen for maximum readability based on viewing angle and instrument temperature. *See end of table for more information about this setting.	2 or 3
Back_Light **[6 to 9]**	Sets the intensity of the backlight. Lower settings correspond to lower intensity, with zero corresponding to backlight off.	Set this to maximum level acceptable for night flying.
Alt	Altimeter - Adjusts altimeter to account for current barometric pressure. Note that the barometric setting is displayed directly below the "Baro" label, and altitude below the "Alt" label.	Set to airport's elevation or current altimeter setting.
Fuel **N/U [0]**	Fuel quantity calculated by the fuel flow function. After adding fuel to the airplane, set this to match the quantity in the airplane. Note: Pressing "Next" and "Display" buttons together jumps you directly to this page from a normal display page. Pressing the left and center button together while on this page sets the fuel quantity to the Max Fuel entry.	Set to match amount of fuel in the airplane. Not applicable if the fuel flow option is not installed.
Max Time **Optional Use**	Alerts pilot when flight time exceeds this limit. Useful as a warning to check fuel. Limit is entered in minutes, so 2 hours is entered as 120, etc.	30-45 minutes less than airplane's endurance.
Interval **N/U [0]**	Provides a warning that repeats at the interval entered in minutes. Useful as a reminder to perform periodic tasks such as switching fuel tanks. Acknowledging this alarm cancels the warning completely, therefore the warning light will not remain on after acknowledging this alarm.	As required. Typically 30-60 minutes is used for changing fuel tank selection.
Max Flow **N/U [0]**	Maximum Fuel Flow – Generates a warning when the fuel flow (rate of fuel burn) exceeds this limit. Useful for detecting badly leaking fuel lines, loose connections to fuel injectors, etc. Very useful safety feature for all engines, but especially fuel injected engines. Be sure to use it!	Set about 10-20% above max fuel flow rate at full takeoff power. Applicable only if the fuel flow option is installed.
Max OilP **[102]**	Maximum Oil Pressure. Useful as a reminder to reduce RPM when warming a cold engine, especially in winter conditions, to avoid excessive oil pressure.	98 or less. Max oil pressure displayed by the instrument is 99 psi.
Min OilP **[12]**	Minimum Oil Pressure – Essential! Be sure to use this one! Warns of loss of oil pressure. As this is the most serious alarm, some pilots may take drastic action when seeing this alarm. Consider you situation carefully if you get this alarm. An instrumentation failure (sensor failure) is possible, as is complete engine stoppage or anything in between. Use your judgement!	As recommended by the engine manufacturer, or 20 psi.
Min Crz_OP **N/U [0]**	Minimum Cruise Oil Pressure - Generates a warning when the oil pressure is below this limit. This limit is active only when the engine RPM is above the min Lim-RPM setting. This allows setting a low oil pressure limit that apply only at higher engine RPM.	As recommended by engine manufacturer, if available. If not provided, set based on experience.
Max OilT **[284 F]**	Maximum Oil Temperature	As recommended by engine manufacturer.
Min OilT **[120 F]**	Minimum Oil Temperature – Intended for troubleshooting engine problems. Also useful as an "engine not warmed up yet" reminder.	Set limit based on experience.
Max RPM **[5700]**	Warns when engine exceeds maximum RPM	Set according to engine manufacturer's recommendation.
Min RPM **[1480]**	Warns when engine RPM falls below this entry. Useful for troubleshooting engine problems. May also be used as a warning that the engine RPM is dropping too low on the landing rollout which could result in engine stall.	Set limit based on experience.
Min Fuel **N/U [0]**	Minimum Fuel Quantity – Generates a warning when the fuel flow function's fuel quantity drops below this limit.	Set to at least enough useable fuel to provide 30-60 minutes of fuel at cruise power. Applicable only if the fuel flow option is installed.
Min Aux (1-6)	Minimum & Maximum for Aux input.	Set limit as needed depending on the

Max Aux (1-6) **N/U[all 0's]**		use of the auxiliary input. Some uses of the auxiliary inputs do not require limits (such as manifold pressure) and some do, such as fuel pressure.
Max H2O **N/U [0]**	Maximum water temperature limit	Set limit as recommended by engine manufacturer
Min H2O **N/U [0]**	Minimum water temperature limit. Intended for troubleshooting engine problems. Also useful as an "engine not warmed up yet" reminder.	Set limit based on experience.
Max Volt **[14.8]**	Maximum Voltage Limit – Allows for detection of failed regulator. Loss of correct voltage regulation resulting in over-charging (and subsequent high voltage) will greatly shorten the life of the battery, and could be dangerous.	Start with 15.6 volts. Lower as much as possible without getting false alarms. Typical limit should be 14.6 Volts.
Min Volt **[11.4]**	Minimum Voltage Limit – Allows for detection of loss of charging. This limit is only tested when the engine RPM is greater than the EGT-RPM setting. This prevents false alarms on final approach (low RPM) with landing lights on.	Set limit to about 12.8 volts to get immediate alerting of loss of charging, although this will cause low voltage alarm whenever instrument is on while engine is not running. Set to 12.4 volts or less to avoid alarm when engine not running, but still gives alarm shortly after battery discharging has begun.
Max Carb **N/U [0]**	Carb temp warning is generated when the carb temp falls between the Max Carb and Min Carb Limit.	40-60 deg F
Min Carb **N/U [0]**	See Max Carb	0-20 deg F
Max EGT **[1500 F]**	Maximum EGT – Not all engines have published limits, nor do all engines require a maximum EGT limit. This alarm can be useful for troubleshooting engine problems also.	Set limit according to engine manufacturer recommendation, or based on experience.
Min EGT **N/U [0]**	Minimum EGT – This alarm is active only when the engine RPM is above the entry for EGT-RPM. This alarm is useful to detecting the loss of a cylinder, or for troubleshooting engine problems.	800-1200 deg F, depending on sensitivity desired. If false alarms are consistently generated, reduce the limit to less than 800 deg F, or set to 0.
Lim-RPM **[3000]**	Defines the RPM at which the following RPM dependant limits become active. These are: Min EGT, Min Volt, Min Crz_OP	Set limit to an RPM slightly less than the RPM used for the MAG check. This allows the Min Volt test to become active during the MAG test to automatically test for charging.
Max EgtSpan **N/U [0]**	Maximum difference between the highest and lowest EGT. This limit can be used to help detect changes in normal engine operation. It is also useful when leaning using the digital leaning pages, as it is possible to not notice a EGT that is abnormally low when using these pages to lean the engine. (Its more obvious on the bar graph pages.)	Set this limit based on experience. It may take some trial and error to arrive at a good limit. After establishing a limit that rarely generates alarms, activation of this alarm may indicate developing engine problem.
Max EGT-Inc **N/U [0]**	Maximum Increase in EGT from the Lean Point. This alarm is active while lean point is active. This alarm will often generate a false alarm when the load on the engine significantly reduced during descent. To avoid this false alarm, reset the Lean Point. (Selecting "Set Lean Page" and "Yes" activates alarm; "Reset" de-activates alarm.)	Set limit based on experience. A small value will allow sensitive detection of EGT increases, which is useful for detection of intermittent problems. Normal operation may require a larger setting to prevent false alarms due to normal EGT fluctuation caused by turbulence or other small power/load fluctuations.
Max EGT-Dec **N/U [0]**	Maximum Decrease in EGT from the Lean Point. See also Max EGT-Inc description.	Set limit based on experience. You may find that this limit is significantly different from the Max EGT-Inc. See also Max EGT-Inc description.

Max Crate **N/U [0]**	Maximum Cooling Rate for CHT – The alarm is provided in degrees/minute, and corresponds to the maximum rate of decrease in CHT. No limit applies to the maximum rate of increase. All cylinders are checked for this limit.	Set limit based on engine manufacturer's recommendation. If no limit is provided, establish a limit based on experience.
Max CHT **[275 F]**	Maximum Cylinder Head Temperature. Often engines will normally operate significantly lower than the engine manufacturer's limit. Consider setting this limit lower than the maximum to get early warning of abnormal CHTs.	Set according to engine manufacturer's recommendation.
Min CHT **[150 F]**	Minimum Cylinder Head Temperature. Intended for engine troubleshooting problems. Also useful as an "engine not warmed up yet" reminder.	Set limit based on experience or to zero if not used.
Display **[1]**	Define which page number is your favorite. The instrument will select this page at power-up, or when leaving the set pages, after all alarms (if any) are acknowledged. This page is also selected by double clicking the "Display" button. See figure 2 for page numbering. This is a very useful feature. Be sure to use it!	Set the your favorite page number.

*__Contrast__ – The contrast of the LCD display is set on this page. Four levels of contrast may be selected, 0-3, with the lower settings best for higher ambient temperatures, and the higher settings best for normal and cooler temperatures. Make your selection to achieve the most desirable appearance of the display. It may be necessary to change it in response to large ambient temperature changes, although this is rare. The contrast setting will automatically reset to level 2 at power-up if it is set below level 2.

5. INSTALLATION

5.1 Mounting the Instrument – Position and other considerations

The first step in mounting the instrument is selection of a suitable location in the aircraft. The location must be selected such that it is not exposed to water or fuel, and preferably away from other devices that generate heat. The instrument does not generate electrical noise that will interfere with radios, nor is it affected by transmissions from radios or engine ignition systems. It is not likely to affect a magnetic compass.

The excellent readability making in non-critical as to where the instrument is mounted with respect to the pilots eyes. The instrument uses an anti-glare window to minimize reflections. Of course the instrument should be positioned to allow easy access to its front panel buttons.

The instrument should be secured using the mounting holes in the faceplate. Figure 4 provides the physical dimensions of the instrument and a full-size mounting template. If the mounting template is used, its dimensions should be verified, as paper may expand and contract with humidity.

NOTE: No special consideration must be given regarding protection from vibration. The mechanical design of the instrument is very rugged. This is of course not true of other instruments, especially mechanical airspeed indicators and altimeters. The instrument does not emit electrical noise that will interfere with any radios, and can be mounted next to a radio without concern. A magnetic compass may also be located next to the instrument if desired, with no measurable effect, on or off.

5.2 Wiring

Figure 5a & 5b illustrates all electrical connections made to the EIS. The "Detailed Wiring Description" below provides additional information about wiring the instrument into your aircraft. Review this material to familiarize yourself before proceeding further.

Using this figure, start the wiring process by carefully planning and **DRAWING A WIRING DIAGRAM** for your aircraft. The wiring diagram is essential in planning a successful installation. Install the wiring, routing all wires required by the EIS to its planned location. A high-quality 22-gauge stranded wire, 7 or 19 strands, is recommended for all connections other than those made to the CHT and EGT probes. Solid conductor wiring is not acceptable. Thermocouple extension wire must be used for the CHT and EGT probes to prevent the introduction of errors into these measurements.

CAUTION: Use a separate ground wires for the ignition kill switches and the remainder of the electrical system if possible. These separate ground wires should attach to different places on the case of the engine so that both sets of grounds could not disconnect from the engine while remaining connected to each other. This provides additional protection for the instrument (although its internal protection is usually more than adequate), but more importantly, protects other electronic equipment in your airplane from potential damage. See the sheet at the back of the manual for more information.

All electrical connections are made to the EIS via two 25-pin sub-D type connectors. Pre-wired, color-coded cables are supplied with the instrument.

1) Start by making the power and tachometer connections as illustrated in figure 7. Note that 10.5-20 Volts DC, 0.20 Amperes is required to power the instrument. The instrument includes an internal thermally activated fuse that protects the instrument. A fuse should be used in the aircraft wiring so that a short in the wiring external to the instrument does not cause an electrical fire. Typically a fuse up to 5 amps may be used for this purpose, depending on the wire gauge and lengths. This fuse may be shared with other items, such as radios and such.

2) For proper operation of the instrument, the ground (black wire) from the instrument must be connected to the case of the engine. Since most engines are grounded to allow operation of the electric starter, only the connection from the instrument to the negative (-) terminal of the battery must be considered. Ideally, the ground wire for the instrument should not be shared with other electrical devices. If other devices share the ground wire used by the instrument, use a digital voltmeter to verify the voltage difference between the case of the EIS, and the negative terminal of the battery is less than 20 mV with all electrical devices which share this ground wire turned on.

3) Do not use the same ground lead for the instrument, and the ignition kill switch(es). Be sure these separate ground leads do not connect to the engine in such a way that they could become disconnected from the engine, but remain connected together.

4) The remainder of the signals are now connected. Accuracy of these sensors is not affected by the length of the leads. Refer to figure 5a & 5b for an illustration of these connections.

5.2.1 Outside Air Temperature Sensor

The sensor for this unit is mounted using the plastic clip. This clip is attached to the airplane, and the sensor snaps into it. To assure maximum accuracy, do not install the sensor such that it is in the path of engine exhaust gases or cooling air outputs. Also avoid attaching it to aircraft structure that is warmed by the sun. The ideal location is under the wing, or under the fuselage for pusher-engine installations. It is very easy for the probe to get warmed by the engine if it is installed behind the engine, usually resulting in readings that are 5-10 deg F too high. Avoid routing the wires to this sensor near radios, ignition systems, or other electronic devices as much as practical. Ground the sensor near then instrument To help prevent electrical noise from affecting the sensor, twist the entire length of leads from the instrument to the OAT probe.

The outside air temperature is displayed in degrees Fahrenheit and Celsius as shown on figure 1.

5.2.2 Water Coolant/Oil Temperature Sensor

Start by installing the sensor in the engine according to the recommendations of the engine manufacturer. After installation, route the wires through engine compartment, making certain the wire is supported so that it will not be chaffed. A connector or terminal strip may be used between the aircraft wiring and the sensor to enhance maintainability if desired. Single-wire type sensors, (those which have a one electrical connection to them) require that their cases be connected to ground. For these sensors pipe thread compound should be used to seal the sensor. Teflon tape should be avoided because it may electrically insulate the case of the sensor from ground. If practical, connect the ground wire to the same point where the instrument is grounded to minimize differences in ground voltages.

5.2.3 Voltmeter

The voltmeter senses its voltage through the power input to the instrument, and thus does not require a separate connection.

5.2.4 Oil Pressure Sender

The oil pressure sender should first be installed on the engine. This sender uses an 1/8-27 NPT pipe thread fitting, but may be adapted to any engine with the appropriate pipe fitting adapters. The sender may also be mounted remotely, using suitable hose connections. This is necessary with some engines, especially Lycoming.

The electrical connections are made through the case of the sender (ground) and the electrical terminal opposite the pipe thread fitting. Ground is normally provided by the engine when the sensor is mounted directly to it, but a separate ground wire may be necessary for remote installations.

5.2.5 Magnetic Tachometer Sensor

See instructions with this sensor for installation recommendations.

5.2.6 External Alarm Output

This output is used to control the external warning light included. The output is an OPEN/GROUND type output. This means that when this output is off (the alarm is not active), this line is equivalent to an OPEN circuit. When this output is on, this output is switched to GROUND. Thus, the external warning light (or annunciator) is connected to this output and +12 Volts. The maximum current this output can control is 0.11 Amperes, or 110 mA. Exceeding 110 mA will normally cause this output to go to the open state, although it is possible to damage this output is the condition is not corrected.

5.2.7 Auxiliary Inputs

Your instrument includes 6 auxiliary inputs. Wire these inputs to your sensors for the auxiliary inputs according to the sheets included with the auxiliary input sensors. Refer to the "Advice Before Starting Your Installation" section at the front of this manual regarding assignment of the auxiliary inputs to the various functions.

If you are using the auxiliary input for your own custom application, this input must be in the range of 0-5 Volts DC, and must not exceed 5.5 Volts. The scaling of this auxiliary display number n is set using the "nSF" and "nOff" as described in the "Configuration Set Pages" section. If this input is not used, the Aux limit should be set to zero on the "Set Limits" pages to prevent nuisance warnings.

CAUTION: This input must not exceed 5.5 Volts. Although no damage will occur the accuracy of the instrument will be adversely affected while an aux input exceeds 6.0 Volts.

5.2.8 Cylinder Head Temperature Probe Installation

Ring-terminal type CHT probes are installed by removing the spark plug, placing the sensor under it, and re-installing the plug into the engine. Orient the sensor so that as much clearance as possible is provided between its leads and the engine structure.

Bayonet type CHT probes (for Lycoming and Continental engines) are retained by a bayonet adapter. This adapter is screwed into the engine, in a threaded hole near the bottom spark plug. This hole can be identified by its solid bottom. ***Do not use the primer hole to mount this adapter! If you are in doubt, consult an expert!*** The CHT probe is adjusted by turning the locking collar on the spring so that its tip is pressed against the bottom of the CHT probe well when it is locked onto the adapter.

NOTE: To prevent false readings for inputs that are not used, it is recommended that unused CHT inputs be shorted together. Unused EGT inputs may also be shorted together, or may be hooked up in parallel with another EGT input so that the EGT Span calculation remains meaningful.

5.2.9 Exhaust Gas Temperature Probe Installation

Start by drilling an 1/8-inch diameter holes at the appropriate position in the exhaust manifold as indicated by the engine manufacturer. If the manufacturer provides no guidance on the location of the EGT probes, we recommend the following:

1) Position the probe 2-8 inches from the cylinder.
2) Although not critical, it is preferable to position all probes the same distance from the cylinder.
3) If possible, position the probes so that they are mounted on a straight (not curving) portion of the exhaust manifold. The hose clamps fit slightly better on straight portions of the manifold.

Cont'd next page

4) Position the hole around the manifold so that the probe does not interfere with the cowl, and takes into consideration practical needs related to maintenance (does not interfere with the access to the oil filter, etc.), inspections, or probe mounting.

Insert the probe into the exhaust manifold and secure it by tightening the clamp firmly. Do not over-tighten.

CAUTION: Secure installation of the exhaust gas temperature sensor is critical to safe operation of your engine. Failure of this sensor to remain installed in the exhaust manifold could result in an exhaust leak of hot exhaust gases containing carbon monoxide. This poses a potential fire and/or cabin air-contamination threat. Inspection of the installation by a licensed A&P mechanic is recommended.

It may be necessary to safety wire the EGT probe such that it is impossible for the probe to come in contact with rotating engine parts or the propeller should its attachment fail. This is especially of concern with pusher-type engine installations.

It is necessary for this probe to be grounded. In most cases no special provisions are required to achieve this, since the exhaust manifold is normally connected to ground via the engine, and the EGT probe clamp typically makes a good electrical connection to the exhaust manifold. An ungrounded probe may cause erratic EGT readings.

5.2.10 Carburetor Temperature Probe

The carburetor temperature probe is mounted in the carburetor such that it senses the air temperature in the venturi. See the sheet that accompanies this probe for further details about its mounting.

5.2.11 EGT & CHT Extension Wire

All models of the EIS correct the EGT and CHT inputs (the thermocouple inputs) for the ambient temperature. This is called “cold-junction compensation”. To perform this compensation accurately, all models of the EIS, except those marked with the “Ext CJ” designation, or those using the temperature compensating terminal strip, require thermocouple extension wire.

Unlike other types of wire, thermocouple extension wire is polarized. Each conductor is made of a different alloy, and is identified by the color of the insulation. It is necessary to use matching extension wire for thermocouple probes, and to observe this polarity, for accurate readings. For example, the EIS requires type J thermocouple for sensing cylinder head temperature. To extend the leads of the cylinder head temperature probe, type J extension wire is required.

Extension wire type is identified by the color of the insulation on the two wires.

Type	Color of Insulation on the Wires	Use
J	Red and White	Cylinder Head Temperature
K	Red and Yellow	Exhaust Gas Temperature

Leave slack in the wire between the engine and airframe to account for engine motion. To avoid confusion, it is a good idea to label each wire to identify which cylinder it is to be used for.

Crimp the mating connectors onto the extension wire. Plug the color-coded leads onto the matching color extension wires. Secure the probe leads with suitable wire clamps to prevent them from chaffing against the engine or airframe. Heat shrink tubing can be used to protect the leads from abrasion, and insulate the electrical connections to the probe.

NOTE : The length of wire on the EGT & CHT probes, or the extension wire may be shortened as desired for your installation.

5.3 Verify the Wiring – A Quick Check

Take a moment now to review all wiring connections you have made to the EIS. Double check the following wiring:

a) power
b) ground
c) tachometer connections

d) Verify that the same ground wire is not used as both a ground to the engine for the EIS, and as a ground for the ignition kill switches. Verify that these separate ground leads do not connect to the engine in such a way that they could be become disconnected from the engine, but remain connected together. Do not use the same connection to the engine for these ground leads.

Finally, install the connector backshell using the supplied hardware. Secure the wiring, using cable clamps to the aircraft structure so that no strain is transmitted to the connector. Plug the connectors into the EIS and secure them to the instrument with the screws included with the back shell.

6. Check-Out

6.1 Initial Application of Power to the Instrument

Apply power to the system Verify that the LCD display becomes active. The instrument will be on display page 0. If this operation is not observed, immediately turn off power to the EIS and recheck all wiring---especially power, ground, 4.8V excitation output and 12V fuel flow power output.

At this point, you may wish to completely configure the instrument for your installation. Refer the section “Configuring the EIS for your Installation”.

6.2 Tachometer Initial Test

Turn on the EIS. The tachometer will display 0 when the engine is not operating. Refer to the “Configuration Set Pages” section, and set the TachP/R according to the type of engine you have. Turn off the EIS. Start the engine; turn on the EIS and verify that the tachometer reading is active and appears reasonable.

6.2.1 Testing Tachometer Inputs

Two inputs are provided for the tachometer sensing. The EIS will use tachometer input 1 when a tachometer signal is sensed. If tachometer input #1 is not providing any RPM indication, the EIS will use the tachometer input #2. Each input must be tested to make sure it is functioning. This test is accomplished by turning off tachometer input #1 (such as by turning off the magneto), and observing is tachometer input #2 provides an accurate and stable tachometer reading. Repeat this by turning off the tachometer input #2 and verifying the tachometer input #1 is accurate and stable.

If desired, a combination page can be programmed to display the tachometer reading being sensed by the tachometer input #2. This is accomplished by selecting "N2" to be displayed on a combination page. N2 will always show the RPM calculated from tachometer input #2. The normal "Tach" display will show EITHER tachometer input #1 if it is available, OR tachometer input #2 if it is available.

6.2.2 Testing Tachometer Accuracy

A simple test to help verify the RPM readings are accurate can be made by running the engine at night, and looking through the propeller at a florescent or mercury vapor light. The pulsation of the light will make the propeller to appear to stopped at various RPMs. Verify the propeller appears stopped at the RPMs shown in the following table. Note that this applies to lights powered by 60 Hz electrical power, such as that used in the United States and Canada. Also remember that this is the propeller RPM, and the engine RPM will by higher by the reduction ratio if the engine includes a propeller speed reduction unit.

2-Blade Propeller	3-Blade Propeller
600	240
720	300
1200	480
1440	600
1800	1200
3600	2400

CAUTION : If there is ANY DOUBT that the tachometer is working correctly, use another tachometer that is known good to verify the EIS is giving the correct tachometer reading. Attempting a take-off with an inaccurate tachometer could result in less than full power being available, and this could be very dangerous.

6.3 Other Checks

CAUTION : Verify that no leaks are observed around the coolant temperature sensor (if so equipped), as well as the oil pressure and temperature sensors. Loss of engine oil or coolant will severely damage your engine, and will result in sudden stoppage.

The remainder of the functions should now be checked out by observing the measurements displayed by the EIS. Any measurements that appear unreasonable should be checked to verify their accuracy.

Your EIS is now ready to use. Please refer to the "Before Each Flight" section.

7. Configuring the EIS for your airplane.

Configuring the EIS for your airplane simply involves setting various entries in the "Configuration Set" pages. These settings tell the instrument details about your engine (such as how many pulses per revolution for the tachometer, units, etc.), how the auxiliary inputs are used, the desired units, etc. The best way to set these items is to work your way through the list describing these settings below.

To access the "Configuration Set" pages, press and hold the center and right button until the screen shows "UP DOWN NEXT" on the bottom row. The display will momentarily show the "Set Lean Pt" page while holding these buttons. This is normal. After about 5-10 seconds, the "Configuration Set" pages will be displayed. This deliberate action is required so that anyone unfamiliar with the instrument will not inadvertently alter the configuration of your instrument.

The settings shown on the "Configuration Set" pages are as follows. The order has been altered by grouping everything related to the auxiliary inputs at the beginning, with the remainder of the settings, in order, following the auxiliary section.

7.1 Setting up your Auxiliary Inputs – Labels and Scaling

You may prefer to wire certain auxiliary functions to particular auxiliary inputs so that they show up together on the labeled page. Aux 1, 2, & 3 are displayed on one labeled page, and Aux 4, 5,& 6 on another. (Of course this data may also be displayed on a programmable page.) After determining this, wire up the auxiliary input as shown on the sheet included with it. Then set the following entries on the configuration set pages.

7.1.1 Aux1, Aux2, Aux3, Aux4, Aux5, Aux6

These pages allow you to define the labels to be used for auxiliary inputs. You may create any label you wish. It may be desirable to use a label with the appropriate number of characters to fit in the space you have defined for it on the combination page.

To change the label, press the left and center button together to enter the "edit" mode. The first character will begin flashing. Use the left and center buttons individually to select the desired character for this position. Use the right button to edit the next character. After editing the last character, the instrument will leave "edit" mode. Pressing the right button when not in edit mode will take you to the next character.

Suggestion! Use 3 character labels for auxiliary inputs configured as integer, since the combination screen will allocate 3 spaces on the screen for auxiliary inputs configured as integers. (Auxiliary inputs configured as decimal numbers will be allocated 4 spaces, making it practical to use 3 or 4 character labels.)

7.1.2 Dual TIT Option and Aux5/Aux6

Instruments that have the dual TIT option can be identified by the "T" in the second letter of the software version, such as "6TS59…". The dual TIT option allows two type K thermocouples probes to provide turbine inlet temperature measurements. These probes are wired to connector A, as shown on figure 5A.

The two TIT inputs are displayed on auxiliary 5 and 6, for TIT1 and TIT2 respectively. While scaling entries (5SF, 5Off, 6SF, and 6Off) are available, these settings are ignored. The labels for auxiliary 5 and 6 may be set as desired, and it is recommended that you set the label for Aux5 to "TIT1" and for Aux6 to "TIT2". The TIT readings may also be displayed on the combination page by selecting Aux5 and Aux6 to display TIT1 and TIT2 respectively.

7.1.3 Auxiliary Scale Factors and Offsets (1SF, 1OFF, 2SF, 2OFF…)

These entries are used to calibrate the auxiliary input so that the value displayed on the instrument has meaningful units and is accurate. Each auxiliary input includes a sheet that tells you the values for the Auxiliary Scale Factor (sometimes abbreviated AuxSF) and the Auxiliary Offset (sometimes abbreviated AuxOff). This instrument uses the labels 1SF & 1OFF for the AuxSF and AuxOff for auxiliary input 1, 2SF & 2 OFF is for auxiliary 2, and so on.

7.1.4 Configuring an Auxiliary Input for a Fluid Temperature Sensor

The auxiliary inputs can be configured to provide accurate readings when connected to a fluid temperature sensor by setting the auxiliary scale factor to a special code of 0. This tells the instrument that the auxiliary input has been wired to a fluid temperature sensor (of the type the instrument has been factor set for, such as type V, or type S as shown on the label on the rear cover). The EIS will then convert the signal on the auxiliary input into a reading in degrees F or C according to the selection on the UNITS page.

The user must install a resistor between the 4.8V output of the instrument, and the auxiliary input used for the fluid temperature, and also connect the fluid temperature sensor to the aux input and ground. The value of the resistor to be used is given in the following table.

Instrument sensor type as shown on the rear cover. This letter will appear in the Software Version.	Value of 1% resistor to connect between 4.8V output and auxiliary input
S	475
V	301

7.1.5 Auxiliary Forward/Reverse Sensing Selection (+/-)

This selection tells the instrument whether each auxiliary input will be sensed forward (increasing voltage = increasing value) or reverse (increasing voltage = decreasing value). The sheet included with the auxiliary input sensor will tell you if forward or reverse is required. In most cases, forward sensing is used.

This page displays all 6 forward/reverse selections on one page. Use the left and center buttons to select the combination that fits your needs. The +/- signs apply, from leftmost to rightmost, auxiliary 1 to auxiliary 6 respecitively. The following screen shows auxiliary 2 to reverse sensing, with all other inputs set to forward sensing.

+	/	-								+	-	+	+	+	+
			U	**P**		**D**	**O**	**W**	**N**		**N**	**E**	**X**	**T**	

7.1.6 Auxiliary Decimal/Integer Selection (D/I)

This selection allows you to chose whether the display includes a decimal point before the last digit (the D selection), or not (the I selection). The decimal selection is useful for displaying such values as Manifold Pressure (inches and tenths of inches of mercury), or possibly fuel level (gallons and tenths of gallons). Integer values are typically used for most auxiliary input functions, including fuel pressure, coolant pressure, ammeter etc. As with the Forward/Reverse sensing function, the leftmost D or I character on the right of the screen applies to auxiliary 1, and the rightmost to auxiliary 6. Use the UP and DOWN buttons to select the desired combination.

7.1.7 Transfer function

The transfer function mathematically defines the relationship between the auxiliary input voltage, and the numeric data displayed on the instrument. This function is of no use to most users, but is provided here for those interested in creating custom applications for the auxiliary inputs.

AuxDisplay = (AuxVoltage * AuxScaleFactor / 2.5) + AuxOffset

Where the *AuxDisplay* is the value shown on the screen, *AuxVoltage* is 0-5 Volts, the *AuxScaleFactor* is the number entered into the 1SF, 2SF, 3SF or 4SF entry. The *AuxOffset* can be a positive or negative value. Negative values are entered into the corresponding 1Off, 2Off, 3Off or 4Off entry as twice their magnitude – 1. Positive entries are entered as twice their values. Thus, if the desired offset is –5, a value of 9 is entered into the instrument. Similarly, if the desired offset is +8, 16 is entered.

7.2 Units – (Fahrenheit/Celsius and Gallons/Liters)

Three characters are displayed on this page. This first (leftmost) selects the units for the altimeter setting, the next for temperature, and the rightmost character applies to the units used by the fuel flow option.

a) To select inches of mercury (the US standard) for the altimeter setting, set the first character to an "I"; for millibars, select "M".
b) To select fuel flow units (applies to flow rate & quantity) of U.S. Gallons, select “G”; for Liters select “L” for the middle character.
c) To select temperature in units of degrees Fahrenheit, set the third (rightmost) character to “F”; for Celsius select “C”.

CAUTION: The limits entered for all temperature data are not changed by this option. Be sure to enter temperature limits in same units as you have chosen for display.

7.3 FC1 & FC2 (Fuel Flow Activation Codes)

For instruments that include the fuel flow option, these entries have no use. For instruments originally ordered without the fuel flow option, these codes are used to activate the fuel flow function, without the need for returning the instrument to the factory for upgrade. In this way, you may easily add the fuel flow option at any time by contacting Grand Rapids Technologies and ordering the fuel flow option. We will supply you with the FC1 & FC2 codes, and a fuel flow sensor.

7.4 FloCal (Fuel Flow Calibration)

This entry allows for fine tuning the accuracy of the fuel flow function. The typical setting for entry is 200. To adjust the FloCal entry to maximize the accuracy of the fuel flow function, keep track of the amount of fuel burned by noting the amount of fuel added to the airplane over a period of time (at least 100 gallons), and the amount of fuel used according the fuel flow function. If the amount of fuel used according the fuel flow function is 1% low, increase the FloCal entry by 1%. Similarly, decrease the FloCal entry by the percentage the fuel flow function is over-reporting fuel used.

The final FloCal entry should typically be within the range of 190-210. If your FloCal entry is outside this range, you may have calculated it incorrectly, or you may have a problem with the fuel flow function caused by flow fluctuations.

When dual fuel flow sensors are used, the FloBias setting must be made as described in the following section before attempting to collect data for fine tuning of the FloCal setting.

7.5 FloCalR (Return Fuel Flow Calibration)

This entry adjusts the scaling of the return fuel flow sensor. It is not used unless your fuel system requires monitoring the outgoing and return fuel, using two fuel flow sensors. If only one flow sensor is used, this setting is ignored, and will not affect the fuel flow calculation.

To adjust this setting for dual fuel flow installations, use the following procedure:

1) Set FloCalR to zero.

2) Turn on the electric fuel pump (with the engine not running), and verify a non-zero fuel flow reading is displayed. Increase the value of the FloCalR in steps. As this setting is increased, the displayed fuel flow should drop. Continue to increase this setting until the displayed fuel flow just becomes zero. Use the lowest setting that results in a zero fuel flow display. A typical setting for this entry is 128, but could vary by +/- 30%.

7.6 TachP/R - Setting for Correct Tachometer Readings

The EIS employs a sophisticated method of measuring engine RPM to provide 10 RPM resolution independent of the number of pulses per revolution of the engine. To provide this flexibility, the TachP/R is set to a code corresponding to the number of pulses the instrument detects per revolution of the engine. To set this correctly for your engine, first determine how many pulses per engine revolution will be generated, according to the following paragraphs, and set the TachP/R as indicated by the TachP/R table. (The tachometer can not measure RPM from analog outputs that encode RPM as a voltage level. This type of tachometer output is rare.)

Two inputs are provided to allow sensing the engine RPM from either of two sources. The EIS will use tachometer input 1 when a tachometer signal is sensed. If tachometer input #1 is not providing any RPM indication, the EIS will use tachometer input #2.

Each tachometer input has a corresponding TachP/R setting allowing them to be independently configured. This allows the use of two dissimilar tachometer inputs, such as a magneto and an electronic ignition input. The settings are identified as Tach1P/R and Tach2P/R, corresponding to each of the inputs.

CAUTION: If there is any doubt about the accuracy of the tachometer reading, verify the reading using another tachometer. Attempting to take-off with less than full power can be very dangerous. In general, if the EIS tachometer reading is not erratic, and the TachP/R setting is correct, the tachometer will be accurate to 5 RPM.

7.6.1 Tach Connections to Magneto P-leads, Ignition Coils or Tach Outputs

These types of tachometer connections typically generate one pulse for every, or every other, spark plug fired per revolution of the engine. Thus 4-cylinder engine will have 1 or 2 pulses per revolution, while a 6-cylinder, 4-stroke engine will have 1.5 or 3. If you choose the wrong setting the tachometer reading will be off by half or double the actual RPM. A 27 k Ohm resistor must be connected between the instrument and the mag P-lead as shown in figure 7 to protect the mag from being turned off by a failure in the instrument.

A magneto or ignition test is commonly performed before each flight for airplanes that include dual ignition systems. This test requires turning off each ignition system, and verifying that the engine will function on the remaining ignition system. Two tachometer inputs are provided to allow sensing the engine RPM from either of two ignition systems so that the RPM indication is not lost during the magneto test.. The EIS will use tachometer input 1 when a tachometer signal is sensed. If tachometer input #1 is not providing any RPM indication, the EIS will use tachometer input #2.

An external switch may also be used to manually select which ignition system provides the tachometer source. Since magneto problems can often be detected early on by erratic tachometer readings, an external switch allows the pilot to choose which magneto is to be monitored, allowing him to choose a different mag on each flight, and thus providing some monitoring of the health of each magneto. A switch can be wired to choose which tachometer output is provide to the EIS tachometer input #1 (as shown on the tachometer wiring diagram), or alternatively, an on/off switch can be wired inline with tachometer input #1. This switch can be opened to force the EIS to use tachometer input #2.

7.6.2 Tach Connections to Lighting Coils (Jabiru, Rotax, and others)

When the tachometer connection is made to the lighting coil, typically 1/2 as many pulses will be generated, as there are poles in the lighting coil. (For 3-phase electrical systems, 1/3 as many pulses as there are poles in the lighting coil.) For CDI-equipped Rotax Engines, 12 magnets are used, generating 6 pulses per revolution of the engine. For non-CDI type Rotax engines, 2 pulses per revolution is generated. Jabiru 4-cylinder engines generate 5 pulses/revolution, and Jabiru 6-cylinder engines generate 4 pulses/revolution.

7.6.3 Rotax 912 Engine

The tachometer output from this engine provides 1 pulse per revolution.

7.6.4 TachP/R Table

Tach P/R Setting*	Pulses per Revolution	Typical Use
0	1.5	6 -cylinder 4-strokes
1	1	4-cylinder 4-strokes
2	2	Rotax 2-cylcle non-cdi
3	3	
4	4	Jabiru 6-cylinder
5	5	Jabiru 4-cylinder
6	6	Rotax 2-cycle CDI
7	7	
8	8	
9	9	
10	10	
11	0.5	
12	12	
13	2.5	
14	3.5	
15	4.5	
16	5.5	
17	1.25	5-cylinder 4-stroke
18	1.75	7-cylinder 4-stroke
19	2.25	9-cylinder 4-stroke inc. M14 Radial
Larger than 19 not valid.	Don't use TachP/R Settings above 19.	Don't use TachP/R Settings above 19.

7.7 TachSen

Each tachometer input includes a sensitivity adjustment, identified as Tach1Sen and Tach2Sen on the configuration set pages. The "L" (low) sensitivity setting is best for most tachometer connections as it provides the greatest amount of filtering and tolerance of noise on the tachometer signal from the engine. The "H" (high) sensitivity setting is best for connections to electronic ignition systems that provide a 0-5V pulse output. Since less filtering is provided when the high sensitivity setting is used, it should not be used unless required.

The tachometer input can tolerate signals of 200V or greater, regardless of the TachSen setting.

7.8 Peak – Leaning Function Sensitivity Adjustment (Not Used for Dragonfly)

This entry serves as a sensitivity adjustment for the digital leaning functions. For a detailed description of its use, refer to the section "Digital Leaning Page".

7.9 Max Fuel – (Fuel Capacity Entry for Fuel Flow Option) (Not Used for Dragonfly)

This entry is used by the fuel flow function to provide a simple means of resetting the fuel quantity to the airplane's usable fuel capacity. By pressing the left and center button together while on the FUEL set page, it will be set to the entry made on this page.

7.10 Hours (Setting Hourmeter)

This function allows you to set the hour meter so that it matches the actual time on your engine. The hour meter may be set to any value between 0 and 6553.5 hours. The hour meter will advance only when the tachometer is above the TIM-RPM entry. It will reset to zero after 6553.5 hours.

7.11 Tim-RPM (Hourmeter & Flight Timer RPM Threshold)

This entry controls the RPM that will activate the Hourmeter and Flight Timer. While the engine RPM displayed by the EIS is less than the entry on this page, the hourmeter and flight timer will not advance. Setting this entry slightly above the

power setting used for taxi will more accurately measure the actual flying time, and will more closely match the tach time. Setting this entry to zero will allow the hourmeter and flight timer to run whenever the engine is running.

7.12 AspdLo, AspdHi, TachLo, TachHi (Landing Checklist Reminder/RPM Range Limit) (Not Used for Dragonfly)

These entries can be used to generate a landing checklist reminder, or as an alarm when operating within a restricted RPM band. The landing checklist reminder is especially desirable in aircraft with retractable landing gear, or for those of you like myself that just can't remember to perform a pre-landing checklist. This is an excellent feature, and I encourage you to use it. It's the kind of automation that helps overcome the unreliability of the human pilot.

7.12.1 Landing Checklist Reminder (Not Used for Dragonfly)

The landing checklist reminder function will generate an airspeed and/or tachometer warning when the following condition is met.

a) The airspeed must exceed the AspdHi setting, and then go below the AspdLo setting. This will generate an airspeed warning (the red warning light will flash, the page will change to the labeled page that includes airspeed, and the airspeed will flash). (Of course, this requires that your instrument includes the airspeed option.)

b) The tachometer must exceed the TachHi setting, and then go below the TachLo entry. This will generate an tachometer warning (the red warning light will flash, the page will change to the labeled page that includes tachometer, and the tachometer will flash).

Acknowledging this alarm (by pressing the "Ack" button") results in the following:

c) After the warning has been acknowledged, the function is reset, requiring the Hi setting to be again exceeded before the alarm is generated again.
d) The warning light will go out when the landing checklist reminder warning is acknowledged.

The recommended setting for AspdLo and TachLo is a setting that is below what you normally encounter in takeoff, climb, cruise, and descent, but above what you encounter when entering the pattern, or while in the pattern. (If you set the "Lo" threshold too low, you may not get the warning until you have already landed, if too high, you may get it long before you are planning on landing.)

The recommended setting for AspdHi and TachHi is a setting that is above what you normally encounter while in the pattern, but reasonably below what you would encounter in takeoff, climb, cruise, or descent. (If you set the Hi threshold too high, you may not ever go above it, preventing a landing checklist warning from being generated, and if you set it too low, you may get the alarm repeated due to power/airspeed changes made while in the pattern.)

You may find some trial and error is necessary to fine tune your settings so your reminder is generated reliably, and not more than once.

An example of the use of this function may best illustrate how to us it. I have found from experience, that based on my flying habits, my RPM does not go below 1900 until I am in beginning my descent in the pattern for landing. I have also noted that while in the pattern, even when making large power changes, my RPM does not go above 2400, although it always goes above 2400 during takeoff. I set my TachLo entry to 1900, and my TachHi entry to 2400. With my flying habits I consistently get an RPM warning (landing checklist reminder really), when I enter the pattern.

Caution : At power-up of the instrument, the checklist function is reset. This means if the instrument is turned off and on again while in-flight, and you do not exceed the "Hi" threshold again, you will not get the warning. Also remember that if something unusual happens (such as partial power loss, staying in the pattern, etc.) , you may not go above your "Hi" threshold, and thus will not get a landing checklist reminder. ***Do not rely solely on the landing checklist reminder function to perform your pre-landing checklist.***

7.12.2 RPM Range Limit

This function is available in software version 5.0 and above, only.

The TachHi, and TachLo settings are also used to specify an RPM range for which an alarm will be generated. When used in this manner, these entries will not function as a checklist reminder.

To use the TachHi and TachLo entries as an RPM range alarm, the TachHi setting must be a lower value than the TachLo setting. When the EIS detects that you have set them in this way, these entries define the RPM range within which it will generate an RPM alarm. For example, if you wish an alarm when the RPM falls between 2000 and 2250 RPM, set TachHi to 2000, and TachLo to 2250.

7.13 AltCor (Calibrating the Altimeter/Barometric Pressure)

To calibrate the altimeter so that the barometric pressure it registers is correct, the follow procedure should be followed. This procedure must be performed with a new instrument, and should be re-checked on an annual basis.

a) Turn on the instrument and allow 5 minutes or more for its internal temperatures to stabilize.
b) Using the Altimeter Set page, set the altimeter so that the barometric pressure display matches the current altimeter setting. Note that this is the 4 digit number immediately after the ALT label on this set page. No decimal point is provided, so an altimeter setting of 29.92 will be displayed as 2992
c) Adjust the ALTCor setting on the configuration set pages so that the altitude display (in feet) matches the local elevation. The nominal value of the ALTCor is 128. Increasing this number by one will change the altimeter display by 6 feet.
d) If your ALTCor falls outside the range of 50-200, you may have made a mistake in your calibration.

7.14 AltSF, 1 (10k), 2 (20k), 3 (30k), 4 (40k) Altimeter Adjustments (SW Version 5.8 and above)

These entries are provided to allow precision calibration of the altimeter. To prevent inadvertent alteration of these entries, they can be accessed only by setting the Max Volts limit to 0.2. These entries will appear immediately after the ALTCor setting. To perform the calibration, set the Max Volts limit to 0.2, and follow the "Precision Altimeter Calibration Procedure" in the following section.

7.14.1 Precision Altimeter Calibration Procedure

1) Set the "AltCor" as described above.
2) Connect an air data test set to the airplane. Be sure the pitot connection is secure, as damage to the airspeed pressure sensor could occur if the pitot connection from the air data test set becomes disconnected during this calibration.
3) Set the air data test set altitude to an altitude near the airplane's ceiling. Use the "AltSF" adjustment to correct the displayed altitude so that it matches the altitude selected on the air data test set. Be sure the altimeter (baroset) setting on the test set agrees with that altimeter (baroset) setting in the EFIS.
4) Set the air data test set to an altitude near sea level. Change the "AltCor" to correct the altimeter reading.
5) It may be necessary to repeat steps 3 and 4 a few times, as there are some interactions between these adjustments.
6) Set the air data test set successively to 10,000', 20,000', etc, and use the corresponding altimeter adjustment (1 for the 10,000' adjustment, 2 for the 20,000' adjustment, etc) to make any correction necessary at these altitudes.

7.15 User Definable Combination Pages

1D1, 1P1, … GD9, GP9

These entries are used to setup your user-definable combination display pages. They are used in pairs (although they appear to 2 successive screens), with the first item of the pair defining the data to be displayed (thus the "D" in the label), and the second item defining the position (thus the "P" in the label) of the item. Two sets of twelve pairs of entries are used to allow up to twelve items to be displayed on each of 2 user-definable combination pages. Nine pairs of entries are provided to allow up to nine items to be displayed on the bar graph pages.

An example of the labels used to identify these page is as follows:

2D1 => 2nd combination page, Displayed item, entry 1
2P1 => 2nd combination page, Position of item 1, entry 1

Note: The items set up for the graphical leaning pages (that is, the pages with the bar graphs), apply to both of the bar graph pages.

Three or four letter identifiers are used to define the data that can be displayed, and a numeric entry describes the position on the screen where this data appears. In addition to numerical data, several characters may be selected to enhance the readability of your user-defined combination pages. The following table describes these items.

EASY TIP: (Do Not Do This) If you would like to restore the instrument to the factory default setup for the user-definable pages, starting from a normal display page (not a set page) turn off the instrument, and press and hold the right button and turn the EIS back on. This will cause the EIS to restore the factory default settings for these pages.

7.15.1 Table of User-Definable Page Entries.

Data to be Displayed	Name used to select this data on the Configuration Set Page.	Number Of Spaces Required	Notes
Nothing displayed	Off	0	This entry is skipped, and nothing is printed to the screen. Set unused entries to "Off".
EGT1	EG1	4	
EGT2	EG2	4	
EGT3	EG3	4	
EGT4	EG4	4	
EGT5	EG5	4	
EGT6	EG6	4	
CHT1	CH1	3	
CHT2	CH2	3	
CHT3	CH3	3	
CHT4	CH4	3	
CHT5	CH5	3	
CHT6	CH6	3	
AUX5	AX5	3 or 4	User selections allow the data to be displayed as an integer (no decimal point), which requires 3 spaces, or a decimal number which requires 4 digits.
AUX6	AX6	3 or 4	
OILT	OT	3	
OILP	OP	2	
VOLT	Volt	4	
AUX1	AX1	3 or 4	User selections allow the data to be displayed as an integer (no decimal point), which requires 3 spaces, or a decimal number which requires 4 digits.
AUX2	AX2	3 or 4	
AUX3	AX3	3 or 4	
AUX4	AX4	3 or 4	
Coolant Temperature	H2O	3	
Not Used	N/U	-	
Not Used	N/U	-	
UNIT	Int	3	This is the internal instrument temperature
QPH	QP		Factory Use Only
FUEL Flow	Flow	4	
TACH	Tach	4	
Highest CHT	CHH	3	
	CHS		Factory Use Only
CHT Rate	CHR	3	
Highest EGT	EGH	4	
EGT Span	EGS	4	
Highest EGT Change	EGPk	4	Leaning info (EGT or delta from peak EGT) for first cylinder to peak. (FRST2PK indicates which cylinder was first to peak.)
FRST2PK	1P	1	Cylinder number of first to peak while leaning.
ROC	VS	2	Vertical speed magnitude – unsigned. Use the

			ROCSGN below to display an up or down arrow next to this value to show climb/dive
ROCSGN	+	1	This is the vertical speed sign (an up or down arrow)
Airspeed	ASP	3	Airspeed
Hourmeter	Hours	6	
Fuel Remaining according to the fuel flow calculation.	Fuel	4	
Altitude	Alt	5	
Flight timer hours	Hr	2	Use a : to separate hours and minutes (and seconds)
Flight Timer Minutes	Mn	2	
Flight Timer Seconds	Sc	2	
Fuel Flow Function's Endurance - Hours	EH	2	Use a : to separate hours and minutes.
Fuel Flow Function's Endurance Minutes	EM	2	
Cylinder number with highest CHT	#C	1	This is not the temperature, but which cylinder has the hottest CHT, such as cylinder #2
Cylinder number with highest EGT	#E	1	Cylinder number with highest EGT
Outside Air Temperature	Oat	3	The outside air temperature will be displayed in deg F only.
Carburetor Air Temp	Crb	3	
Barometric Pressure setting for altimeter	Baro	5	
ROCSGN (rate of climb sign - up arrow for climb, down arrow for dive)	+	1	This is the vertical speed sign (an up or down arrow)
Colon symbol	:	1	Allows printing of a : to the screen.
Apostrophe	' (foot symbol)	1	Allows printing of a ‘ to the screen.
degrees symbol	degrees symbol	1	Allows printing of a degree symbol to the screen.
"/"	/	1	Allows printing of a / to the screen.

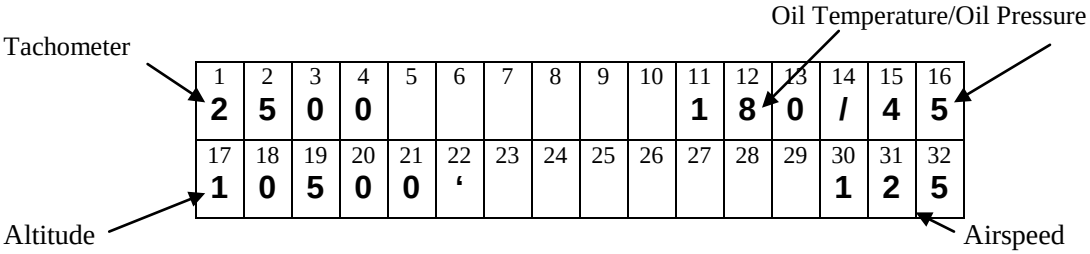
The following illustration shows the numbering of positions on the display screen for the user-defined pages. Note how the 32 character positions are numbered from 1-32 starting in the upper left corner.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

7.16 Example Worksheet for setting up your custom pages.

The easiest way to create your custom pages is to plan them on page, and then translate you plan into the entries that you will make in the instrument. To illustrate this, lets create a simple page.

1. Start with a blank worksheet. Fill in typical numbers to illustrate the data you want displayed. Use the table entry of "Number of Spaces Required" to allocate the required space for the items you have selected to display. In this example, the tachometer, oil temperature, oil pressure, altitude and airspeed are displayed as shown.



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	**5**	**0**	**0**							**1**	**8**	**0**	**/**	**4**	**5**
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	**0**	**5**	**0**	**0**	**'**								**1**	**2**	**5**

2. Once satisfied with the layout, create a list of the entries. Use the table above to determine the identifier used by the instrument for each of the items. Fill out the list.

1D1 = TACH
1P1 = 1
1D2 = OT
1P2 = 11 ← Note that this number corresponds to the start of the data being displayed.
1D3 = /
1P3 =14
1D4 = OP
1P4 = 15
1D5 = ALT
1P5 = 17
1D6 = '
1P6 = 22
1D7 = ASP
1P7 = 30
1D8 = Off
1P8 = 0
1D9 = AUX1 ← The entries set to "Off" are ignored.
1P9 = 8
1D10 = Off
1P10 = 0
1D11 = Off
1P11 = 0
1D12 = Off
1P12 = 0

3. Enter these into the instrument's "Configuration Set" pages.

7.17 Worksheet for Planning User-Definable Pages (Shown as set at Pitman Air)

Note: > denotes field going further spaces

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
T	**A**	**C**	**H**		**O**	**T**	**>**	**/**	**O**	**P**		**E**	**G**	**H**	**>**
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
A	**L**	**T**	**>**	**>**		**+**	**V**	**S**					**C**	**H**	**H**

Combo Page #1

1D1 = Tach
1P1 = 1
1D2 = OT
1P2 = 6
1D3 = /
1P3 = 9
1D4 = EGH
1P4 = 13
1D5 = Alt
1P5 = 17
1D6 = +
1P6 = 23

1D7 = VS
1P7 = 24
1D8 = CHH
1P8 = 30
1D9 = off
1P9 = 0
1D10= off
1P10 = 0
1D11= off
1P11 = 0
1D12= off
1P12 = 0

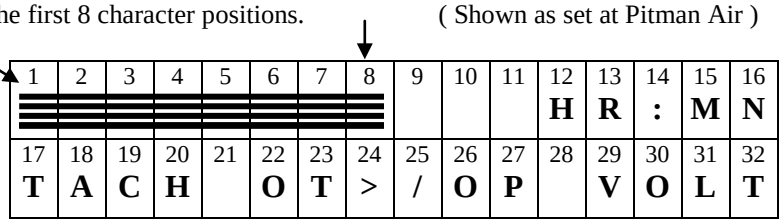
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
T	**A**	**C**	**H**		**V**	**O**	**L**	**T**		**E**	**G**	**H**	**>**	**/**	**#E**
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
O	**T**	**>**	**/**	**O**	**P**						**C**	**H**	**H**	**/**	**#C**

Combo Page #2

2D1 = Tach
2P1 = 1
2D2 = Volt
2P2 = 6
2D3 = EGH
2P3 = 11
2D4 = /
2P4 = 15
2D5 = #E
2P5 = 16
2D6 = OT
2P6 = 17

2D7 = /
2P7 = 20
2D8 = OP
2P8 = 21
2D9 = CHH
2P9 = 28
2D10= /
2P10= 31
2D11= #C
2P11= 32
2D12= off
2P12= 0

Bar Graphs use the first 8 character positions. (Shown as set at Pitman Air)



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
											H	**R**	**:**	**M**	**N**
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
T	**A**	**C**	**H**		**O**	**T**	**>**	**/**	**O**	**P**		**V**	**O**	**L**	**T**

Graphical (Leaning) Pages

Note: Don’t assign any items to position 1-8, as this space is reserved for the bar graphs. The setup for this page applies to both bar graph pages.

GD1 = Hr
GP1 = 12
GD2 = :
GP2 = 14
GD3 = Mn
GP3 = 15
GD4 = Tach
GP4 = 17
GD5 = OT
GP5 = 22
GD6 = /
GP6 = 25
GD7 = OP
GP7 = 26
GD8 = Volt
GP8 = 29
GD9 = off
GP9 = 0

8. Disabling Pages (Pitman Air disables Pages 0, 4, 6, 7, 9, 11, 12, 13, 14, & 15)

Up to 10 display pages may be disabled so that they do not appear when pressing the "Next" and "Previous" buttons. Disabling pages can make it easier to get to the pages that you find the most useful. You may find it useful to disable labeled pages which include information also shown on your programmable combination pages. You may also find it useful to disable the fuel flow page if you do not have the fuel flow option, and/or the altimeter/VSI - Airspeed - Water Temperature page if you do not use these features. Note that the alerting function will not be disabled from using this pages, so that alarms will be annunciated using the appropriate labeled page.

It is recommended that pages are disabled after you have gained some operational experience with the instrument, and after you have settled on the configuration of your user-programmable pages.

To disable a page, determine its page number from figures 1a and 1b. Enter this page number into one of the 10 "Disable Page #" entries which appear immediately after the user-definable page data.

Note: Ten "Disable Pg #" pages are provided. Each of these pages allow one entry. The entry may be either "Off" (indicating this particular "Disable Pg #" page is not disabling any pages), or it may be a number between 0 and 15 corresponding to the page being disabled. The ten "Disable Pg #" pages look identical, with the possible exception of the entry on the page. This gives the appearance that the page is not changing as you page through each of the 10 pages, but in fact there are ten of these pages.

9. Engine Analysis Functions

The engine analysis function includes functions to track your EGTs to detect subtle changes in your engine performance, and functions to help you lean your engine.

9.1 The EGT Tracking Function

Imagine you had a way of watching your engine for the slightest change in its operation for every second of the cruising portion of your flight. Imagine this function was sensitive enough to detect a single spark plug just beginning to foul, or a valve intermittently sticking, or a minute intake manifold leak, or a host of any other problems which could not possibly be detected by the human senses. Imagine the confidence you will feel as you set out over forests, mountains, or a body of water, knowing that your engine has been subject to this scrutiny. This is the real power of the EGT tracking function. Please read on….

The tracking function is normally activated during the cruise portion of the flight. This is because the exhaust gas temperatures will vary with the mixture, power setting, and load on the engine. During the cruise portion of the flight these variables are fixed, making changes in exhaust gas temperature due to engine problems easier to detect. This is especially true during flight in smooth air, where there is no turbulence to cause fluctuations in engine power

To activate this function, call up the “SET LEAN POINT?” prompt by momentarily pressing the center and right buttons. Press the button under the “YES” selection to activate the function. This will store the current exhaust gas temperatures internally, and calculate the change from these temperatures for each cylinder. You will now see a graphical representation of the change in exhaust gas temperature on the EGT Cruise graph, and a digital representation of the change on the page identified with CZ (cruise) identifier. The exhaust gas temperatures stored internally for this function may be updated at any time during the flight by repeating this sequence. (This can be necessary if your cruise conditions change, such as power settings, mixture, etc.). Note that it is not necessary to lean the engine to activate this function.

Separate limits may be set for the increase and decrease in exhaust gas to alert you when any cylinder varies by more than you expect. These are the EGT-INC and EGT-DEC entries on the set pages. These limits may be tight (a few 10’s of degrees) to alert you to very subtle changes, possibly at the expense of false alarm in turbulence, or loose (50 degrees or more). Experience will dictate the best settings for your engine/airplane combination.

The tracking function may also be activated during climb or descent if desired. This is especially useful when troubleshooting an intermittent problem. (It may be necessary to re-activate it during this phase of the flight to account for the change in exhaust gas temperatures resulting from the new power setting.)

9.2 Leaning Functions (Not used with Rotax Engines)

For those with engines having adjustable mixture controls, the leaning functions are probably what attracted you to the EIS, and you will not be disappointed. The EIS provides a bar graph page for those who prefer this method, and a digital leaning page (identified by an "L" in the lower right corner). It is recommended that you try both methods several times to determine which one is your favorite. In general I prefer the digital leaning pages because they provide finer resolution (1 degree vs. 15 degrees per bar graph segment), but this can be a matter of taste, as the bar graph page can make it easier to visualize the EGTs.

9.2.1 Leaning with the Bar Graph

Using the bar graph page to lean is simply a matter of selecting the page, and adjusting the mixture while observing the EGTs via the bar graphs. You may find it useful to customize the bar graph pages to include information that could make it easier to lean, such as MAP, RPM, Fuel Flow, or the special leaning functions, such as the First-to-Peak and EGPk.

9.2.2 Digital Leaning Page

To understand the digital leaning page, (the page with the "L" in the lower right corner), it is first necessary to understand a few basic rules about the data shown on this page.

a) When a cylinder is close to its highest EGT, the cylinder's EGT is displayed.
b) When a cylinder's EGT is more than the amount specified on the "PEAK" setting below the highest EGT, a negative value will be displayed showing how far this cylinder's EGT is below its highest.
c) The highest EGT for a cylinder is continually updated. That is, whenever an EGT goes above the internally stored value for the highest EGT, it is updated.
D) Selecting the "Save Lean Point?" page, and selecting "RESET", will reset the highest EGT for each cylinder to its current temperature.

In light of these rules, the typical procedure for leaning is as follows:

1) Select the digital lean page. This is the page with the "L" in the lower right corner.
2) Select the "Save Lean Point?" window, and select "RESET". This resets the highest EGTs to the current temperatures. You will note that immediately after doing this, the lean page will show all positive values since all EGTs will be the newly stored highest. This also causes the First-to-Peak indicator to reset to 0.
3) Slowly lean the engine. As you do, the EGTs should all increase (unless you have a cylinder already operating past peak EGT, in which case it will decrease, indicating an engine problem exists). As the EGTs increase, the instrument will be updating its internal highest for each cylinder, and the numbers on the page will show EGTs.
4) As leaning continues, a cylinder will reach it peak EGT, and then begin to fall. Once it has fallen by more than your setting for "PEAK" below its highest, the value shown on the screen will switch to a negative number. The First-to-Peak function will now indicate which cylinder number was the first to peak.
5) Typically the engine is then enriched to 50 degrees rich of peak (although this is a matter of your preference). As you enrichen, all EGTs will drop, except those that were leaned past peak. The cylinders which were leaned past peak with first increase, and then decrease. The key to making it simple, it to ignore all but the first to peak (the first to go negative). Use this cylinder to adjust mixture to your desired setting (such as 50 degrees rich of peak).

Note that the leaning page is typically most meaningful while leaning, and for several minutes after leaning. This is because of the effect of the highest EGT always being re-computed. Consider for instance the scenario where you leaned a hour ago, but during the last hour you made some power changes, encountered turbulence, changed altitude, or similarly caused the EGTs to reach new highs. Once re-stabilized in cruise, even if the EGTs returned to the same temperatures they were at immediately after leaning, the new highs for the EGTs stored internally will cause the lean page to show different values than that showed immediately after leaning.

The "PEAK" setting allows you to specify how sensitive the instrument will be to detecting the first cylinder to go past peak. As you lean, an exhaust gas temperature could go down a few degrees during the leaning process due to varying engine loads (turbulence) or other factors. The instrument will not declare a cylinder to be the first to peak unless it is the first cylinder to fall by the amount specified in the "PEAK" setting from the maximum temperature that cylinder has achieved.

9.2.3 Special leaning functions

Two special functions are provided that are helpful when leaning. These functions are selectable on the user-definable pages, and are provided on the factory default bar graph pages.

9.2.4 First-Cylinder-to-Peak (FRST2PK)

This function indicates which cylinder peaked first during leaning. This function will display 0 after selecting "RESET" from the "SAVE LEAN POINT?" page. It will remain as 0 until a cylinder has peaked (fallen by more than the "PEAK" setting from its highest EGT). Once the first cylinder has peaked, this function will show which cylinder was the first to peak. It will not change until "RESET" is selected from the "SAVE LEAN POINT?" page.

9.2.5 EGPk (First-Cylinder-to-Peak Leaning Status)

This function displays the leaning page information for whichever cylinder was the First-to-Peak. The function will display 0 until a cylinder peaks, and then displays either the current exhaust gas temperature for this cylinder if it is currently less than the "PEAK" setting of its maximum EGT, or the number of degrees below the peak EGT detected.

Note that it is perfectly feasible (depending on your leaning preference) to lean the engine using only the EGPk display. Using this display alone, you can lean until the first cylinder peaks, and enrichen (or not) as desired.

9.3 Shock Cooling Detection

The cylinder head rate-of-cooling (in degrees/minute) for the cylinder head temperature that is dropping the fastest is provided by this function. This information is provided on a labeled page above the "CRate" label. A maximum cylinder head rate-of-cooling limit may also be set. Consult your engine manual to see if such a limit is published for your engine. If no limit is published, you may determine a limit by trial and error. While not all agree that shock cooling of the cylinders is a real problem, there is no doubt that internal stresses in the cylinders can be reduced by avoiding shock cooling. In addition, some of our customers with glider towing operations are convinced that shock cooling can cause cylinder cracking.

10. Detailed Description of Other Functions

10.1 Flight Timer

At power-up of the EIS, the flight timer shows the length of the previous flight in hours and minutes. This makes it easy to recall the last flight time if power is turned off to the instrument before the time is noted. This time will be displayed until 3 minutes into the next flight, at which time it will be replace with the length of the current flight in hours, minutes and seconds. It is especially useful for measuring the progress on cross country flight since it never forgets to start! For those who forget to wear a watch, and who don't have a clock or a GPS, this timer can be handy for navigation purposes also!

10.2 Unit Temperature

This function is displayed on the hourmeter page, and shows the internal temperature of the instrument. It is used by the instrument for cold-junction compensation of the EGTs and CHTs. It is also useful for estimating the cabin temperature, as it tends to stabilize at about 30-35 degrees F above the ambient temperature.

The unit temperature can also be checked to see if the instrument is being exposed to excessive heat. Unit temperatures above 170 degrees F can degrade the readability of the display. (The display will return to normal when it is cooled to normal temperatures.) Temperatures above 200 deg F can activate the internal thermal fuse, shutting down the instrument.

10.3 H2O (Water Temperature Function)

This function is provided for those using water-cooled engines. It may also be useful for measuring other temperatures in the range of 80-300 degrees F, such as under cowl temperatures, especially for composite airplanes.

11. Use with Precision Airmotive Eagle Engine Controller

The EIS is compatible with the Precision Airmotive Eagle engine controller. The following notes apply for installations with this system.

Fuel Flow - No flow sensor is installed in the fuel lines. The fuel flow output from the engine controller should be connected to the EIS fuel flow input as shown in the engine controller documentation. Per this documentation, a 1k ohm resistor is connected to the fuel flow output of the engine controller, and the other side of this resistor connects to 5 or 12V. We recommend using the fuel flow +12V for this voltage. For the fuel flow function to work, the EIS must be equipped with the fuel flow option. The FloCal entry should be set to 177, and adjusted as necessary so that the totalizer is accurate. When the totalizer is accurate, the fuel flow reading will be accurate. It is normal for the fuel flow readings to fluctuate as much as 10% at times.

Tachometer - Similar to the fuel flow input, the tachometer input is "pulled-up" with a 1k ohm resistor to 12V. The EIS fuel flow output is ideal, and can easily supply the necessary power for both the fuel flow and tachometer sensing.

CHT - The engine controller monitors 2 cylinder head temperatures. The CHT probe used for the engine controller can not be used for the EIS CHT input. To monitor these cylinder head temperatures it is necessary to use a dual CHT probe (available from Aircraft Spruce). The EIS requires a type J thermocouple.

12. Updating the EIS Software

EIS Model 4000 instruments with software version 70 or greater (as shown in the software version number on the label, or as might be displayed on the screen at power-up) include field re-programmable memory that allows the instrument to have software updates loaded into it via its serial port.

Software updates can be loaded in the EIS via its serial port from either a loader cable connected to a personal computer, or via any version of the GRT Horizon or Sport EFIS. When loading EIS software via the EFIS, a serial output to the EIS and from the EIS must be connected. Earlier versions of the EIS did not allow for software updates to be loaded into them via the serial port, and thus did not have a serial output connected to the EIS serial input. This connection must be made to allow loading software updates into the EIS.

13. Check Entries Message

The “Check Entries” message will be displayed immediately after power-up if the EIS determines that any user entry (including all limits and all configuration data) was lost or is incomplete. When this message is the EIS will force you to review all entries by taking you to the Set Limits and Configuration Set pages. Carefully review and correct any entries as necessary.

Note: This message will be generated if any user entry is changed, and the instrument is turned off before returning to the normal display pages. This message then serves a reminder that you were in the process of setting user entries when the instrument is last turned off.

If this message appears frequently, this is most likely due to the instrument getting poor quality electrical power. This is most common if the instrument is on while engaging an electric starter, or if it is turned on before the engine is started in airplanes without batteries, or when power or ground connections are loose.

14. Troubleshooting Common Problems

Instrument does not turn on. Warning light is on steady.	Either the instrument is not receiving power, or the 12V or 4.8V output from the instrument is shorted to ground. A simple test is to make a cable with only power and ground wires, and power the instrument via this cable. (This test cable available at no charge.)
Instrument does not turn on. Warning light never comes on.	Open ground connection to instrument, or the voltage provided to the instrument is too low (less than 9V).
One EGT or CHT is erratic.	One of the two wires is unconnected between the instrument and the probe. Most commonly, a crimp connection on the quick disconnect on the probe, or the cable it plugs into, is loose. A visual inspection will usually be enough to find the problem. Another simple test is to use a continuity tester, and verify each pin at the instrument end of the cable has good continuity to the engine case, since each probe is grounded to the engine. The pins numbers are listed on the wiring diagram in the back of this manual.
All EGT and CHT are erratic.	This is caused by an open ground connection to the case of the engine on engines which do not include an electric starter.

Oil Pressure Reads 99 with engine off.	Connection to oil pressure sensor is open circuit. A quick test is to touch the oil pressure lead to ground. This should cause the oil pressure to read 0. If it does, check connections and ground to oil pressure sensor (case must be grounded.) If this test does not cause a 0 reading, check the connection between this wire and the input to the instrument.
Oil or Coolant Temperature shows 59 deg F all the time.	The connection to the oil or coolant temperature probe is open, or not grounded. A quick test is to touch the coolant temperature sensor lead to ground. If the EIS show a high temperature, the connection to the instrument is good. If it does not change, check the wire between the instrument, and the oil or coolant temperature sensor, especially the crimp on the quick-disconnect that plugs onto the coolant temperature sensor.
Tach Reading is zero when one mag is turned off.	This is normal, as the tach signal is generated by one of the mags.
Tach is erratic.	Tachometer resistor is not installed, or its value is too low. See wiring diagram for tachometer connection.
Tach reading is steady, but too low or too high.	TachP/R is incorrectly set. See "Configuration Set Pages" section.
Voltmeter reads to high. All else OK.	An "update" version of software has been installed, and the setting on the Units page (the H/N setting) is incorrect.
Voltmeter reads above 20 V and other readings incorrect.	More than 5 volts is being applied to an auxiliary input. This can be caused by an incorrectly calibrated capacitance fuel fuel probe, a open ground wire to the manifold pressure sensor, or similar. Check the aux inputs be see if any are above 5 volts using a voltmeter.

15. Warranty

Grand Rapids Technologies Incorporated warrants this instrument to be free of defects in material and workmanship for 2 years from the date the system is first used, or 5 years from date of purchase. This warranty includes parts and labor. The instrument includes a lifetime warranty for any manufacturing defects. Grand Rapids Technologies expressly reserves the right to repair or replace a defective unit with new or reconditioned parts or equipment, of the same or similar design. This warranty is void if damage to the instrument is caused by incorrect connection of the tachometer lead, or is otherwise installed incorrectly. This warranty also does not cover the following:

A) Damage during shipment
B) Damage from accident, misuse, negligence, lightning, or water
C) Damage caused by alteration or unauthorized repair

Legal Rights/Limitations of Liability

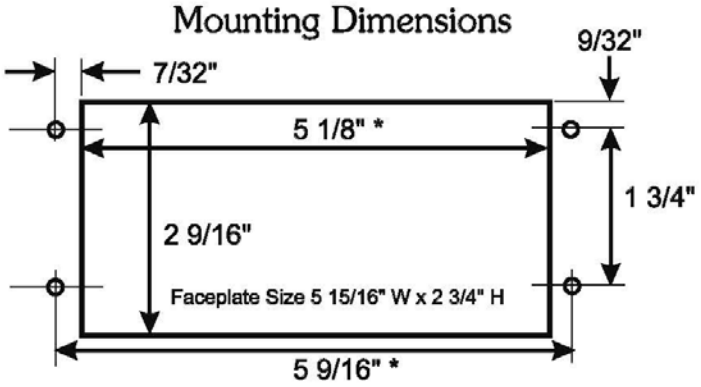
Grand Rapids Technologies Incorporated is not liable for incidental or consequential damage, commercial loss, or any other loss or damage not specified in this warranty. Some states do not allow limitations on the length of implied warranties, or exclusion or limitation of incidental or consequential damages. The above limitations or exclusions may not apply to you. No individual or company may extend this warranty. This warranty is valid only for the original purchaser.

Service may be obtained by returning the instrument to this address:

Grand Rapids Technologies
3133 Madison Ave SE
Grand Rapids, MI 49548
Attention: Service Dept.

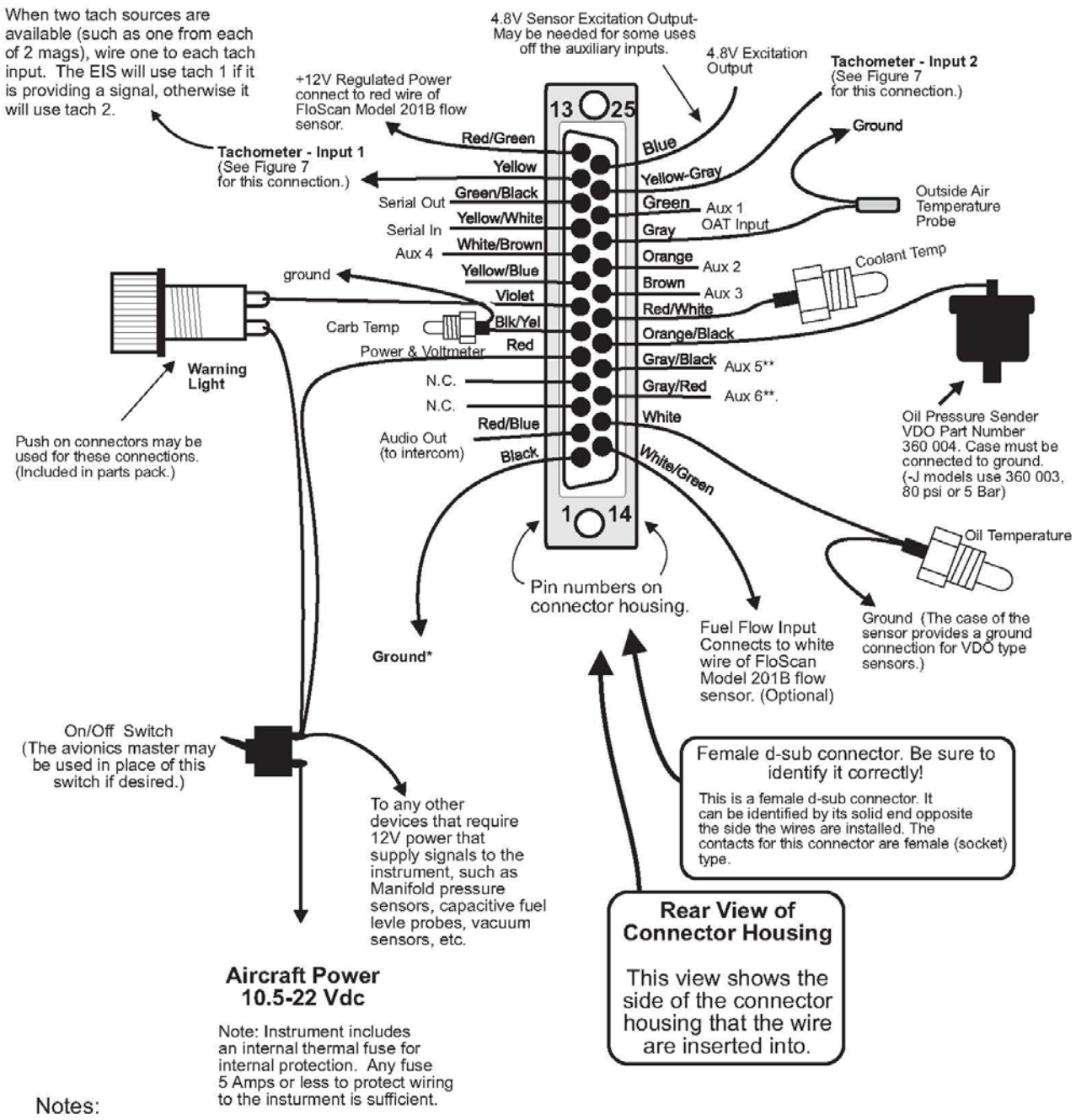
When returning the instrument for service, please specify the nature of the problem. Include a copy of your proof of purchase for warranty repairs.

For service questions or repair rates, call 616-245-7700.



Note: Instruments are 2 3/8" deep. Allow 3/4"-1 1/2" additonal depth for connectors on rear of instrument. The warning light requires a 9/16" diameter mounting hole.

Figure 4. Mounting Dimensions


When two tach sources are available (such as one from each of 2 mags), wire one to each tach input. The EIS will use tach 1 if it is providing a signal, otherwise it will use tach 2.
Tachometer - Input 1
(See Figure 7 for this connection.)
+12V Regulated Power connect to red wire of FloScan Model 201B flow sensor.
4.8V Sensor Excitation Output- May be needed for some uses off the auxiliary inputs.
4.8V Excitation Output
Tachometer - Input 2
(See Figure 7 for this connection.)
Ground
Outside Air Temperature Probe
Aux 1 OAT Input
Coolant Temp
Aux 2
Aux 3
Aux 5**
Aux 6**.
Oil Pressure Sender VDO Part Number 360 004. Case must be connected to ground. (-J models use 360 003, 80 psi or 5 Bar)
Oil Temperature
Ground (The case of the sensor provides a ground connection for VDO type sensors.)
Fuel Flow Input Connects to white wire of FloScan Model 201B flow sensor. (Optional)
13
25
1
14
Red/Green
Yellow
Serial Out
Green/Black
Yellow/White
Serial In
Aux 4
White/Brown
Yellow/Blue
Violet
Blk/Yel
Red
N.C.
N.C.
Red/Blue
Audio Out (to intercom)
Black
Blue
Yellow-Gray
Green
Gray
Orange
Brown
Red/White
Orange/Black
Gray/Black
Gray/Red
White
White/Green
ground
Carb Temp
Power & Voltmeter
Warning Light
Push on connectors may be used for these connections. (Included in parts pack.)
Pin numbers on connector housing.
Ground*
On/Off Switch (The avionics master may be used in place of this switch if desired.)
To any other devices that require 12V power that supply signals to the instrument, such as Manifold pressure sensors, capacitive fuel levle probes, vacuum sensors, etc.
Female d-sub connector. Be sure to identify it correctly!
This is a female d-sub connector. It can be identified by its solid end opposite the side the wires are installed. The contacts for this connector are female (socket) type.
Rear View of Connector Housing
This view shows the side of the connector housing that the wire are inserted into.
Aircraft Power 10.5-22 Vdc
Note: Instrument includes an internal thermal fuse for internal protection. Any fuse 5 Amps or less to protect wiring to the insturment is sufficient.

Notes:

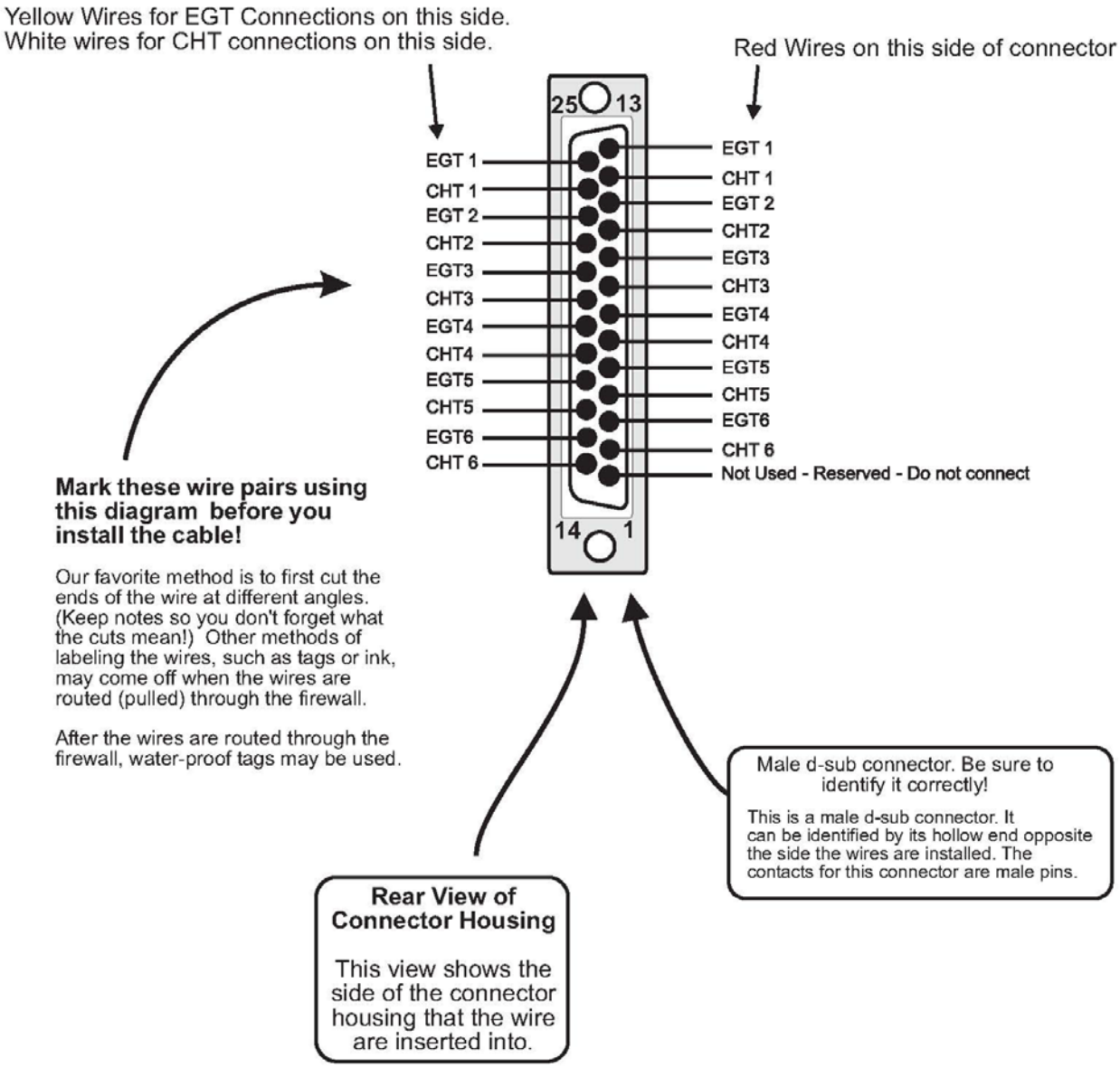
**Aux5 and Aux6 apply only to instruments with software versions xxx46, or instrument labeled as 6 Aux Inputs. For all others, these inputs should be unconnected.

* See the "Installation" section, "Wiring" sub-section of the manual for notes regarding proper grounding.

N.C. indicates No Connection. Do not wire to these inputs. They are reserved for future growth.

Figure 5a -- Connector A Wiring for Model 4000/6000/9000

fig5ab16.dual tach input.cdr


Yellow Wires for EGT Connections on this side.
White wires for CHT connections on this side.
Red Wires on this side of connector
25
13
14
1
EGT 1
CHT 1
EGT 2
CHT2
EGT3
CHT3
EGT4
CHT4
EGT5
CHT5
EGT6
CHT 6
EGT 1
CHT 1
EGT 2
CHT2
EGT3
CHT3
EGT4
CHT4
EGT5
CHT5
EGT6
CHT 6
Not Used - Reserved - Do not connect
Mark these wire pairs using this diagram before you install the cable!
Our favorite method is to first cut the ends of the wire at different angles. (Keep notes so you don't forget what the cuts mean!) Other methods of labeling the wires, such as tags or ink, may come off when the wires are routed (pulled) through the firewall.
After the wires are routed through the firewall, water-proof tags may be used.
Male d-sub connector. Be sure to identify it correctly!
This is a male d-sub connector. It can be identified by its hollow end opposite the side the wires are installed. The contacts for this connector are male pins.
Rear View of Connector Housing
This view shows the side of the connector housing that the wire are inserted into.

Notes:

Type K thermocouple extension wire must be used for EGT connections, and type J thermocouple wire must be used for CHT connections when the External Cold-Junction input is not used.
For Model 4000 versions, EGT5, EGT6, CHT5 & CHT6 are not used.

fig5bb16.cdr
rev A

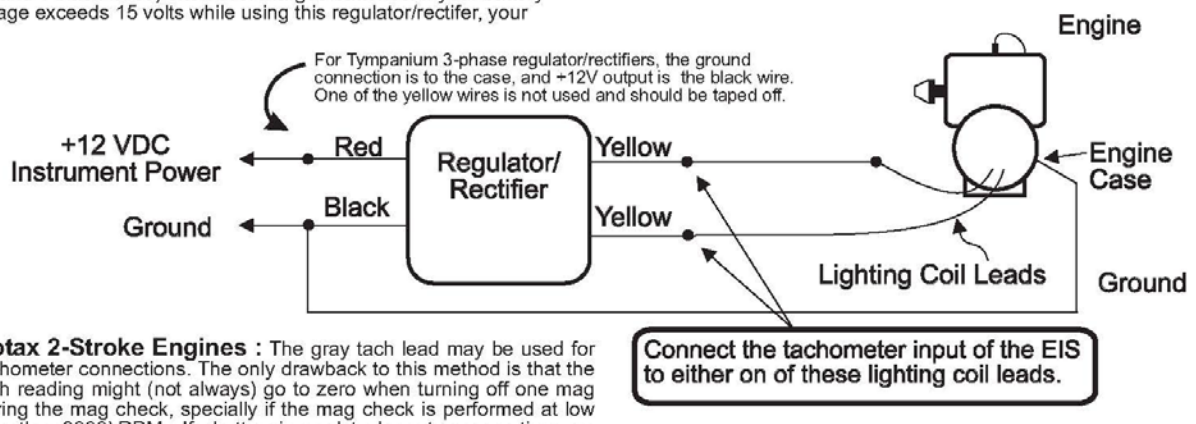
Figure 5b -- Connector B Wiring

Rotax (Tympanium) Regulator/Rectifiers -- (Also applies to Jabiru, HKS, and most others not otherwise listed.) Only one of the two inputs to the regulator/rectifier will give a good tachometer reading. The incorrect lead will give a tachometer reading that decreses with engine rpm. The correct lead must be determined by trial and error.

The small Tympanium regulator rectifier (identifed by its 2 yellow, 1 red and 1 black wires) often overcharges batteries. If your battery voltage exceeds 15 volts while using this regulator/rectifer, your

Making the tachometer connection is dependant on the type of

Key West Regulator/Rectifier. The gray tachometer lead must be used. The lighting coil wires may not be used as a tachometer soure with this regulator/rectifier.


For Tympanium 3-phase regulator/rectifiers, the ground connection is to the case, and +12V output is the black wire. One of the yellow wires is not used and should be taped off.
Engine
+12 VDC Instrument Power
Red
Black
Ground
Regulator/ Rectifier
Yellow
Yellow
Engine Case
Lighting Coil Leads
Ground
Connect the tachometer input of the EIS to either on of these lighting coil leads.

Rotax 2-Stroke Engines : The gray tach lead may be used for tachometer connections. The only drawback to this method is that the tach reading might (not always) go to zero when turning off one mag during the mag check, specially if the mag check is performed at low (less than 3000) RPM. . If a battery is used, tachometer connection may be made to the lighting coil as shown above to avoid loss of the tach reading during the mag check.

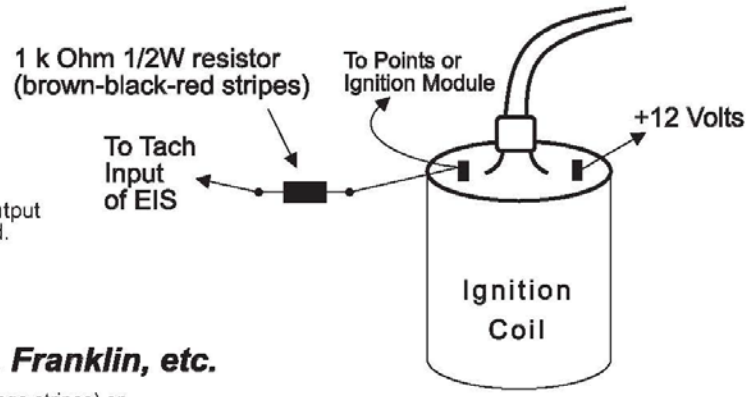
Figure 7a. Tachometer Connections to Lighting Coil Equipped Engines (Rotax, Jabiru, Hirth, Zenoah, etc.)

Electronic Ignition

Connect directly to the tach output from the igntion system. No resistor required.

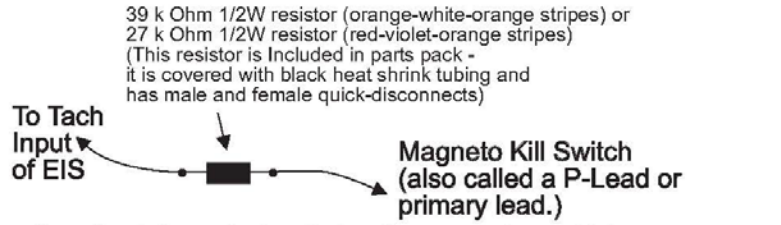
Rotax 912/914

Connect tach input to one of the two tachometer output wires. Connect the other tach output wire to ground.

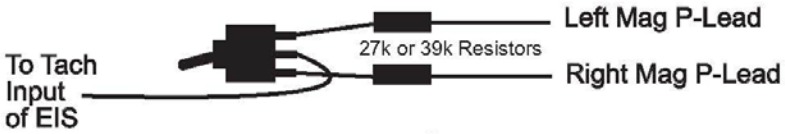


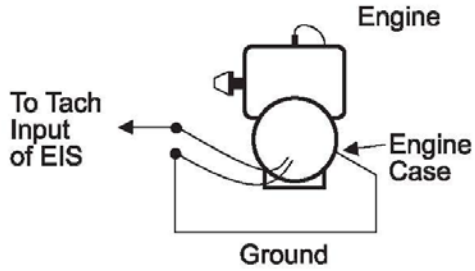
Point-Type Ignition

Magneto Equipped Engines such as Lycoming/Continental, Franklin, etc.


39 k Ohm 1/2W resistor (orange-white-orange stripes) or
27 k Ohm 1/2W resistor (red-violet-orange stripes)
(This resistor is Included in parts pack -
it is covered with black heat shrink tubing and
has male and female quick-disconnects)
To Tach Input of EIS
Magneto Kill Switch (also called a P-Lead or primary lead.)

Note: A switch may be installed to allow you to chose which mag you use as your tachometer source. This allows you to select the active mag when performing a Mag Drop Test.





Spare Lighting Coil

Figure 7b. Other Tachometer Connections (Model 2000/4000/6000 EIS)

tach.cdr Rev C

Appendix A2 EIS 4000 912/914 End Appendix A2

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Appendix B - Flight Training Supplement

SERIAL NUMBER:_____

Flight Training Supplement

THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO PITMAN AIR AND SHALL NOT BE USED, RELEASED, OR DISCLOSED IN WHOLE OR IN PART WITHOUT EXPRESS WRITTEN PERMISSION FROM PITMAN AIR

Record of Supplement Revisions

Note* A current version of this manual is always available
on the internet at: http://www.moyes.com.au/manuals

# Revision Number & Date	dd/mm/yyyy Headings	Paragraph	Page numbers
Rev.1	18/11/2010 Original	All	All
Rev. 2	26/03/2012 Complete revision to Accepted ASTM Standard F2746-09	All	All
Rev 3	04/04/2013 Revised to include 582 & 912's	All	All

Warning

Limited Aerobatics

The Dragonfly was not designed for many Aerobatic Maneuvers,
Prior authorized maneuvers only with proper training!

Solo Flight from Front Seat Only!

Always Insure that Weight & Balance are within Limits!

Owner/Operator Responsiblities

The Owner/Operator is responsible for Maintaining the Aircraft
in accordance with the Inspection and Maintenance Procedures
as defined in the Pilot Operating Handbook & Maintenance Manuals.

Safety of Flight and/or Service Difficulties must be Reported as soon as possible, by using a copy of the Form in the POH by Mail or Online at:
www.pitmanair.com/dragonfly/sofreportform.htm

The Owner is Responsible for keeping all Current Contact Information on file at Pitman Air. This can be done by Mail or Online at:
www.pitmanair.com/dragonfly/contactform.htm

Current versions of all Manuals are at available Online at:
www.pitmanair.com/dragonfly/manuals

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1 – GENERAL

1.1 Read this before your first training flight

This document is provided to supplement the information provided in the Pilot Operating Handbook (POH-Flight Manual) but does not replace it. Specific information on operation of the engine and systems are provided in the POH. Specific information on maintenance is contained in the Bailey Moyes DRAGONFLY Maintenance Manual provided with each aircraft, and available online at: www.pitmanair.com/dragonfly .

Please pay attention to the pre-flight check and maintenance instructions for the aircraft, the Rotax ® engine and the SECOND CHANTZ emergency parachute system and the operation manuals for other installed equipment such as the EIS and SECOND CHANTZ Parachute.

Do not attempt to learn the basics of these systems in the aircraft. Preparing by studying the basic operation of this equipment prior to your first transition training flight will be time well spent.
The Bailey Moyes DRAGONFLY is equipped with non-certified engines. Flying the DRAGONFLY must always be done with the possibility of a safe landing due to the loss of the engine power.
The Bailey Moyes DRAGONFLY is a VFR Only Aircraft. Because of the low cruising speed and range of the DRAGONFLY, flight into vastly different weather patterns and meteorological conditions are not likely to occur. Vigilance is still important and required. The entry into bad weather with IFR conditions by VFR pilots and aircraft is extremely dangerous. Vigilance of changing conditions is required. As the owner or operator of an aircraft you are responsible for the safety of your passenger and yourself. Do not attempt to operate the DRAGONFLY in any manner that would endanger the aircraft, the occupants or persons on the ground.

WARNING:
Use alkali-free cleaning products only to clean both the structure and engine!
NEVER USE "Simple Green"

1.2 Manufacturer

Pitman Air
1840 Airport Blvd.
Red Bluff, CA 96080
Ph 530 529 3030
Ed 530-945-1860 Pacific Time
ed_pitman@hotmail.com
www.pitmanair.com
\
Bobby Bailey 352 429 5660 Eastern Time
Rhett Radford 603 690 5200 Eastern Time

1.3 Australia Parts Facility

Lite Flite Pty Ltd.
1144 Botany Road
Botany NSW 2019
Australia
Ph. +61 2 9316 5543
Fax +61 2 9316 8488
Email bill@moyes.com.au

2 PREFACE: LIGHT SPORT AIRCRAFT

Light Sport Aircraft may seem familiar to us by their appearance, but they are in fact quite different from the traditional aircraft we are used to. First, LSAs weigh significantly less than many aircraft. With a typical empty weight of approx.515 pounds and a maximum take-off weight of up to 1080 pounds, they are indeed light aircraft. The light weight, coupled with a generous wing surface area, means that they have a low wing loading making them more susceptible to wind currents than larger, more heavily loaded aircraft. A good pilot needs to remain vigilant from the time the aircraft first moves under its own power, until after the landing is complete and the aircraft is brought to a full stop.
Also, the weight constraints of designing and building a safe and practical LSA mean that only a certain amount of the design can be devoted to shock-absorbing, ground maneuvering, equipment (the landing gear). It is a good idea for us to try to improve our flying skills and develop good flying techniques so that we may continue to enjoy many happy accident-free hours of operation.
It is important to become familiar with the sight picture (the view) when looking out of your aircraft before your first flight and you will find that your landings are directionally more consistent and you are better able to judge your flare. Remember that it's been said that the main wheels are for landing, the tail wheel is only for steering on the ground.
The different flight characteristics the transition can be more than many expect. It is recommended, to not rush through your transition training, and become thoroughly comfortable with all aspects of the aircraft.

The Dragonfly is capable of flying surprisingly slow. Make it a goal to become comfortable and safe at both ends of the speed range. At slow speeds, become familiar with aircraft's flight characteristics and learn to recognize the onset of a stall. Learn and practice correct stall recovery technique for your particular aircraft.

3 LSA TRANSITION SYLLABUS

3.1 Overview

The objective of transition training is for a pilot to develop the knowledge, skill and proficiency to operate an unfamiliar model of aircraft. The training should not be limited to flight training but should also include ground training. The syllabus used should be effective and tailored to the student's individual experience and needs. Previously learned skills may be useful in the learning process, but **differences should be emphasized**. At the end of the course, the transitioning pilot should be able to demonstrate having reached the objective and meeting the standards by the use of oral, written and practical test standards (PTS).
The training should include but not be limited to:

- The aircraft systems specific to the Dragonfly Aircraft.
- The flight characteristics and limitations
- The care and cleaning of aircraft made from modern materials. - Modern aircraft engines
- Responsibilities of Owners and Operators of Light Sport Aircraft.

Information pertaining to transition training can be obtained from government publications as well as from leading industry organizations.

3.2 Objective
The overall objective of the transition training is to obtain the required knowledge and skill level to safely operate a Bailey Moyes DRAGONFLY.

3.3 Completion Standards

At the end of the course, the transitioning pilot should be able to demonstrate having reached the course objectives and meeting the completion standards by the use of oral, written and flight testing. The student will demonstrate knowledge of the Pilot Operating Handbook (POH), the aircraft systems and limitations, and the regulations pertaining to Light Sport Aircraft and Sport Pilot. The demonstration will include emergency as well normal procedures.

3.4 Areas of Operation and Tasks

In a manner similar to Practical Test Standards put forth by the FAA, the Instructor will establish Areas of Operation corresponding to specific areas of knowledge and/or skill needed by the student to complete the transition training. Within each Area of Operation the instructor will identify specific Tasks that can be completed by the student in order to demonstrate proficiency.

3.5 Ground Training Systems and Limitations

The instructor should not only provide an overview of the aircraft, but also an in-depth description of the aircraft systems, their operation and their limitations. The description should include a discussion on how the systems may be different from what the student has previously experienced.
Areas of operation

I. Aircraft overview [Complete review of information in Pilot Operating Handbook (POH)]
II. Flight and System controls [Refer to POH]
III. Flight Instruments [Refer to POH]
IV. Performance and Limitations [Refer to POH]
V. Power-Plant & Propeller [Refer to POH]
VI. Electrical System [Refer to Maintenance Manual]
VII. Fuel System [Refer to Maintenance Manual]
VIII. Landing Gear [Refer to Maintenance Manual]
IX. Weight and Balance [Refer to POH]
X. Specific Avionics installed [Refer to POH]

3.6 Flight Training

3.6.1 Preflight

The purpose of a preflight inspection is to determine the airworthiness of an aircraft in preparation for flight. The transitioning student must learn to determine the overall condition of the aircraft and establish its maintenance status. Items of note are: documents, placards and inoperative equipment.

3.6.2 Flight Training Standards

Upon completion of flight training, the student will demonstrate a skill level appropriate to the Light Sport Pilot Practical Test Standards or to the level of pilot certificate held, if higher.

3.6.3 Areas of Operation

I Flight Planning for Light Sport Aircraft

II Preflight Procedures

Ill Surface Operations

IV Takeoff, Landings and Go-arounds

V Navigation

VI Slow flight

VII Emergency Procedures

VIII Post flight Procedures

The DRAGONFLY is a conventional aircraft that has conventional characteristics and procedures. The aircraft is aerodynamically high in drag and pilots being transitioned to the DRAGONFLY need to be trained to manage their airspeed carefully. This requires a significantly steeper nose down attitude without power.
The rapid acceleration to takeoff and the angle of climb is different from conventional aircraft.
Landing the DRAGONFLY requires attention to controlling and maintaining airspeed in the pattern and final approach to landing. After practice, the DRAGONFLY can be landed in very small areas safely.
This section is an outline of typical procedures for flying a DRAGONFLY. It is represented here as a preliminary-overview only. More detailed explanations including emergency procedures are listed in the Pilot Operating Handbook (POH) provided with the DRAGONFLY. The Student should read the POH prior to training.

4.1 Take-off

If the runway and approach to the runway are clear. Roll out to the take-off position. • If it is possible, take-off directly into the wind.

- The maximum direct crosswind component at take-off 12 mph.
- Confirm the tail wheel is centered.
- Controls in proper position for takeoff.
- Apply the throttle smoothly to fully open (forward).
- **582** Engine speed: approx. 6500 RPM & left rudder
  912/914 Engine speed: approx. 5500 RPM & right rudder
- As soon as the airplane accelerates, gently pull back on control stick - keep the tail wheel slightly weighted until the airplane takes off.
- At take-off, release the back pressure on the stick and allow airspeed build to 42 mph. At initial climb speed up to 48 mph. Climb to a minimum height of 650 ft.AGL in straight ahead flight before attempting to turn the aircraft or reduce to best climb speed.

4.2 Climb

Climb to a minimum height of 650 ft. in straight ahead flight before attempting to turn the aircraft or reduce to best climb speed.

4.3 Limitations (for a complete list of limitations please refer to the POH) The DRAGONFLY is not certified for Aerobatics. Some Aerobatics are approved with proper training.

- Flights are only to be made under VFR conditions.
- Night flights require special optional equipment, Private Pilot or Higher w/current medical.
- Flights in icing conditions not allowed.
- Steep turns beyond 60 Degrees are prohibited. see Aerobatic Maneuvers in POH
- In gusty wind or wind speed more than 30 mph (46 km/h) flight operations should be stopped.

4.4 Cruising Flight (Carb Icing)

912 During Cruising Flight, an RPM of 4200 - 5500 RPM should be used (redline is 5800 RPM). The maximum permissible speed of V_{ne} 65 mph should not be exceeded. 65 – [70 mph ** (with trim set to slow speed, 40 mph or less)]
582 During Cruising Flight, an RPM of 4300 - 5800 RPM should be used (redline is 6800 RPM). The maximum permissible speed of V_{ne} 65 mph should not be exceeded. 65 – [70 mph ** (with trim set to slow speed, 40 mph or less)]
During Cruising Flight, monitor your fuel consumption and total fuel on board for flight planning. Fuel Consumption at typical Cruising flight is about 4.0 to 4.7 gallons per hour. In case of possible **carburetor icing**, go to cruise or maximum power setting.
For Normal Cruising Flight, bring the airplane to the desired cruising speed in level flight by observing the VSI or the Altimeter. Adjust the throttle and trim to hold altitude.

4.5 Banked Turn

Each direction of turn should be made with the coordinated use of the aileron and rudder. Steep turns in excess of 60degrees are not recommended. At lower speeds in tight turns, the airplane loses altitude quickly. Banked turns with more than 30degrees of banking should not be carried out less than 35 mph. If the airplane enters an inadvertent spin, position the control stick in neutral position for recovery then push the rudder opposite the spin direction.. After the spin rotation stops, center rudder and recover to level flight carefully to not exceed Vne 66 mph. or the load limits of the aircraft.

4.6 Stalls

The DRAGONFLY is very docile in stalls. The loss in altitude during stalls is approx. 65ft, with a maximum pitch down of 25degrees. The aircraft is resistant to stalling in-cruise configuration. During stalls coordination of controls can affect roll tendency and is easily countered by use of the rudder.

The stall speed at 490 kg (1080 lbs.) gross weight is approxemately..38 mph (Minimum Controllable Airspeed MCA)

The stall is noted through light buffeting. At 2 kts.(3 mph) above the stall speed, the rudder becomes "soft". When flying close to stall speed, only the rudder and elevator are fully controllable. The ailerons have less effectiveness in very slow flight. The airplane loses about 65 ft. in altitude during a stall. Close to the ground, do not fly slower than a minimum speed of about 43 mph.

In the case of a stall-spin entered through crossed controls, oppose a spin with opposite rudder input. Center the ailerons and elevator until the rotation stops, then level out the airplane gently.

If the attempt to level out the airplane fail or leveling out is doubtful because of too low altitude the Emergency Parachute System should be actuated. Remember, SECOND CHANTZ recommends at least 500’ AGL to safely deploy the parachute.

4.7 Approach and Landing

Land into the wind, or the runway with the least crosswind if possible. The final approach to landing is to be carried out in level attitude. In case of carburetor icing hazard, Open Throttle gently to free ice.

Engine power at: about 10-20 % slightly above idle to confirm that the engine still has power.

Approach speed about 40 mph (solo) to 50 mph at gross weight.

At the distance of 1 to 3 ft. over the ground close the throttle and land the airplane gently.

When landing with crosswind, perform a crabbing approach or slip carefully.

Light wind landing can be 3 point

Gusty wind landing is best on main wheels and approach at slightly higher speed

The flights low over obstacles during approach to landing should be avoided.

4.8 Control of the Emergency Location Transmitter ELT

Before switching off the radio equipment, adjust frequency to the international emergency frequency 121.5 and check if the ELT is activated.

4.9 Engine stop

Under normal conditions, the engine is sufficiently cooled during the landing approach and roll-out, therefore it can be stopped through Ignition Switches Off. The Radios and Instruments should be Switched Off before stopping the engine.

5 STANDARD EQUIPMENT

This chapter provides brief information about standard equipment installed on the aircraft.

Warning: This is supplemental information for convenience only, the binding information is given by the instrument manuals.

5.1 Altimeter in the EIS

Refer to Appendix A of this Pilot Operating Handbook

5.2 Airspeed Indicator

Standard 2 ¼” or 3 1/8” Airspeed Indicator w/ markings

5.3 Grand Rapids Technologies Inc. EIS 2000 or 4000 (refer to Appendix A)

The EIS’s versatile design accommodates a wide range of engines and sensors. You may configure the system to meet your monitoring requirements covering both air- and water-cooled engines. Its warning capabilities provide early notification of problems that might otherwise go unnoticed.

All normal operation of the EIS happens via the display panel. The front panel contains buttons and a display.

Functions:
2 to 4 Exhaust Gas Temperatures
2 Cylinder Head Temperatures
Tachometer
Oil Temperature
Oil Pressure
2 to 6 Auxiliary Inputs - user configurable
Flight Timer
Hour Meter
Voltmeter
Outside Air Temperature
Coolant Temperature
Manifold Pressure
Fuel Flow

Features:
Alarms on most functions, most with upper and lower limits
Label/Data Flip-Flop identifies all data on combination pages
User-Selectable Units (Fahrenheit/Celsius & Gallons/Liters)
Serial Output – Allows data recording using a laptop PC, or interface to EFIS Graphical Engine Monitor.
Serial Input – Provide for growth to interface with other system options that can be included in your EIS:
EGT Max - Active only when above a specified RPM.
EGT Min - Active only when above a specified RPM.
CHT Shock Cooling - Max cooling rate

5.4 Tachometer Time

In EIS refer to 5.3 above& Appendix A

Record and track the total elapsed time that aircraft is in use. These escapement - controlled DC hour meters are electrically powered with jeweled movement, shockproof odometer and permanently lubricated parts. Total digital quartz readout is 999.9 hours. Easy-to-read LED numerals on black face dials. Sealed against dirt and moisture.

5.5 ELT Ameriking AK450 (Installation and operation manual)

The AK-450 ELT, Emergency Locator Transmitter, is a state of the art CMOS technology, long lasting, solid state based equipment. It is an extremely reliable, highest standards of quality, designed to meet TSO-C91a requirements for critical application.
The entire ELT system is self-powered by its own internal Batteries. Interface with Aircraft Electrical Power System is not required.
The AK-450 ELT is automatically activated upon sensing a change of velocity of 3.5 +10.5 Feet/Second, along its longitudinal axis (Automatic Fixed - ELT (AF) Configuration). It is designed to be removed from the Aircraft and used as a personal locating device when it is necessary to leave the scene of the accident (Automatic Portable - ELT (AP) Configuration).

5.6 Intercom

Self-Contained portable units of owners choice can be temporarily attached to the aircraft. i.e. Velcro, straps, etc……

6 RECOVERY PARACHUTE SYSTEM

The specific operating instructions and limitations for the SECOND CHANTZ 1100 # Parachute are located in the SECOND CHANTZ owner's manual supplied in the aircraft documents. More specific information is also located in the Pilot Operating Handbook.
The SECOND CHANTZ Parachute System (Optional) in the DRAGONFLY is a very high performance system. The Vne of the parachute system is above the Vne of the aircraft. In an emergency, the parachute system should be activated even if at a very low altitude.
Before activating, if it is possible, Stop the Engine and Tighten the Pilot and Passenger Seat Belt Harnesses. The parachute system handle is located in the central console above & between the seats. To activate the system, the handle has to be pulled to the stop.
The history of emergency parachute use in light aircraft has shown that pilots have to be mentally prepared to use of the system before the need arises. The process of Looking, Reaching and Pulling is a way to practice mentally, the physical action of activation.
Briefing your passenger on the use of the system is important in the unlikely event of the pilot being incapacitated. Make certain to always replace the safety pin in the activation handle on the ground.

7 PERFORMANCE

Performance data is based on an aircraft in good condition and correct settings. Even the smallest adjustments to the controls or the omission of a small piece of fairing can adversely affect aircraft performance. Sufficient reserve should be added to the data given in this handbook to cover all such possibilities.
Performance data for GROSS WEIGHT @ 490kg (1080 Ibs.)

Take-off roll:
582UL Solo ≈ 225ft. Gross Weight 1080 ≈ 300 – 345 ft.
912UL Solo ≈ 215 ft. Gross Weight 1080 ≈ 280 – 335 ft.
912ULS Solo ≈ 185 ft. Gross Weight 1080 ≈ 245 – 300 ft.

Take-off distance over 50' obstacle:
582UL Solo ≈ 650ft Gross Weight 1080 ≈ 950ft
912ULS Solo ≈ 600 ft. Gross Weight 1080 ≈ 790 - 825 ft.
912ULS Solo ≈ 450 ft. Gross Weight 1080 ≈ 590 - 605 ft.

Take-off Speed:
Solo 38 mph
Two place 42 mph

Best Rate-of-Climb:Speed (Vy)
582UL 42 mph ≈ 850 fpm (solo) 47 mph ≈ 350 fpm @ GROSS WEIGHT
912UL 42 mph ≈ 1000 fpm (solo) 47 mph ≈ 550 fpm @ GROSS WEIGHT
912ULS 42 mph ≈ 1200 fpm (solo) 47 mph ≈ 800 fpm @ GROSS WEIGHT

Best Angle-of-Climb (Vx):
582UL 37 mph ≈ 750 fpm (solo) 44 mph ≈ 350 fpm @ GROSS WEIGHT
912UL 37 mph ≈ 900 fpm (solo) 44 mph ≈ 500 fpm @ GROSS WEIGHT
912ULS 37 mph ≈ 1100 fpm (solo) 44 mph ≈ 750 fpm @ GROSS WEIGHT

Maximum level speed V_H:

582UL Cruise at ≈ 4600-5000 rpm will give ≈ 45-50 mph solo
Consumption at cruise is ≈ 4.0 US gal per hour
Range is approximately ≈ 45 - 50 miles (no wind 500' MSL with 30 min reserve)

912ULS & 912UL Cruise at ≈ 4100-4300 rpm will give ≈ 49 - 54 mph solo
Consumption at cruise is ≈ 2.8 US gal per hour
Range is approximately ≈ 70 - 80 miles (no wind 500' MSL with 30 min reserve)

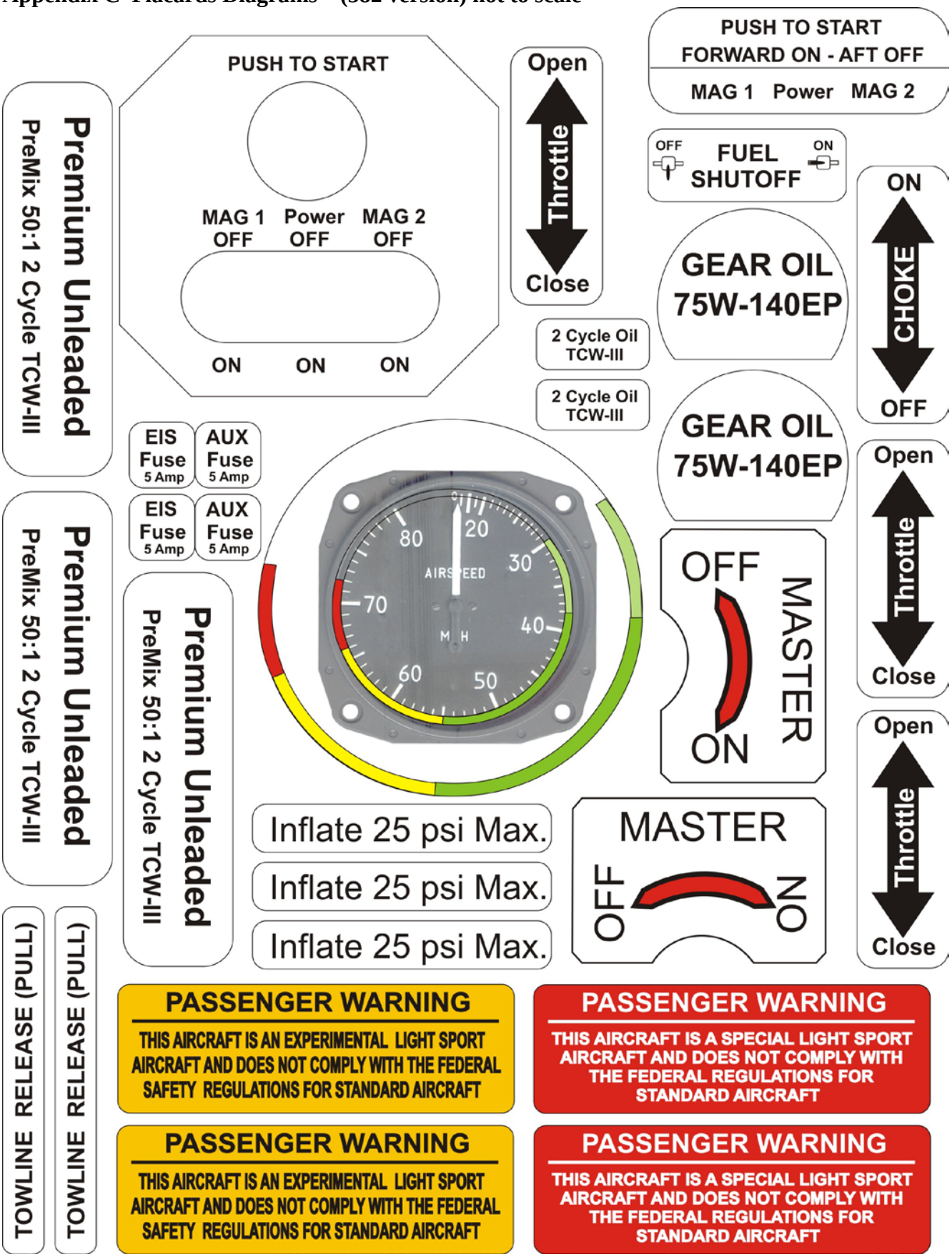
Maximum range: (6 Gallon Tank) with 30 min. reserve.

582UL ≈ 50 sm @ 5200rpm.,
912UL ≈ 78 sm @ 4300 rpm.,
912ULS ≈ 70 sm @ 4300 rpm

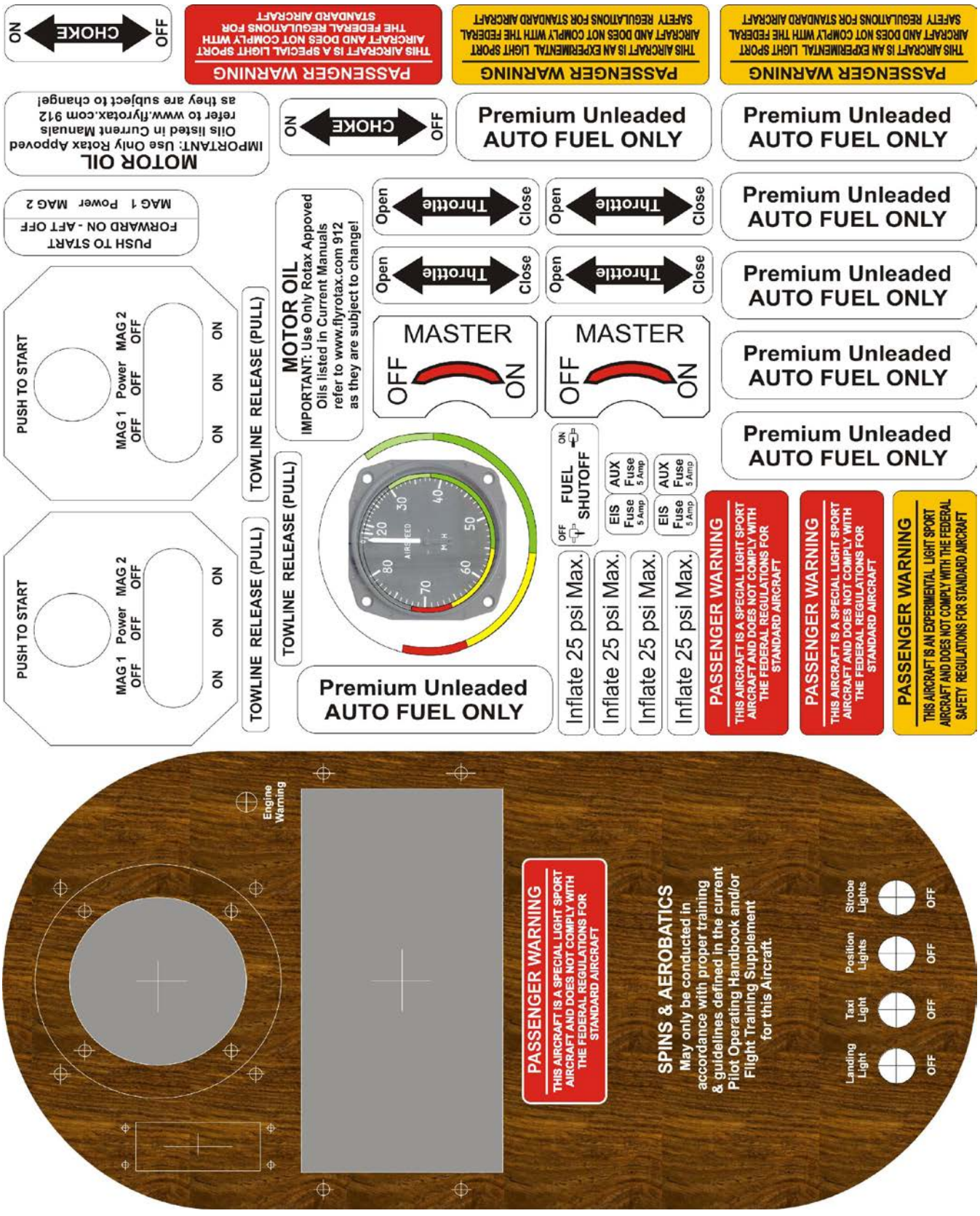
NOTE: All performance data are based on standard atmosphere at sea-level. They are also based on the procedures described in the POH. Higher runway elevations, higher temperatures and other propellers can lead to considerable differences in the data!

End of Appendix B FTS in POH

Appendix C Placards Diagrams (582 version) not to scale


PUSH TO START
MAG 1 OFF
Power OFF
MAG 2 OFF
ON ON ON
Open
Throttle
Close
PUSH TO START
FORWARD ON - AFT OFF
MAG 1 Power MAG 2
OFF FUEL SHUTOFF ON
ON
CHOKE
OFF
GEAR OIL 75W-140EP
2 Cycle Oil TCW-III
2 Cycle Oil TCW-III
GEAR OIL 75W-140EP
Premium Unleaded
PreMix 50:1 2 Cycle TCW-III
EIS Fuse 5 Amp
AUX Fuse 5 Amp
EIS Fuse 5 Amp
AUX Fuse 5 Amp
Premium Unleaded
PreMix 50:1 2 Cycle TCW-III
Premium Unleaded
PreMix 50:1 2 Cycle TCW-III
OFF MASTER ON
Inflate 25 psi Max.
Inflate 25 psi Max.
Inflate 25 psi Max.
MASTER
OFF ON
TOWLINE RELEASE (PULL)
TOWLINE RELEASE (PULL)
PASSENGER WARNING
THIS AIRCRAFT IS AN EXPERIMENTAL LIGHT SPORT AIRCRAFT AND DOES NOT COMPLY WITH THE FEDERAL SAFETY REGULATIONS FOR STANDARD AIRCRAFT
PASSENGER WARNING
THIS AIRCRAFT IS A SPECIAL LIGHT SPORT AIRCRAFT AND DOES NOT COMPLY WITH THE FEDERAL REGULATIONS FOR STANDARD AIRCRAFT
PASSENGER WARNING
THIS AIRCRAFT IS AN EXPERIMENTAL LIGHT SPORT AIRCRAFT AND DOES NOT COMPLY WITH THE FEDERAL SAFETY REGULATIONS FOR STANDARD AIRCRAFT
PASSENGER WARNING
THIS AIRCRAFT IS A SPECIAL LIGHT SPORT AIRCRAFT AND DOES NOT COMPLY WITH THE FEDERAL REGULATIONS FOR STANDARD AIRCRAFT

Appendix C Placards Diagrams (912/914 version) not to scale


PASSENGER WARNING
THIS AIRCRAFT IS AN EXPERIMENTAL LIGHT SPORT AIRCRAFT AND DOES NOT COMPLY WITH THE FEDERAL SAFETY REGULATIONS FOR STANDARD AIRCRAFT
Premium Unleaded AUTO FUEL ONLY
Open Throttle Close
MASTER OFF ON
FUEL SHUTOFF
AUX Fuse 5 Amp
EIS Fuse 5 Amp
Inflate 25 psi Max.
PUSH TO START
MAG 1 Power MAG 2
TOWLINE RELEASE (PULL)
MOTOR OIL
IMPORTANT: Use Only Rotax Appoved Oils listed in Current Manuals refer to www.flyrotax.com 912 as they are subject to change!
CHOKE ON OFF
PUSH TO START
FORWARD ON - AFT OFF
MAG 1 Power MAG 2
Engine Warming
Landing Light
Taxi Light
Position Lights
Strobe Lights
SPINS & AEROBATICS
May only be conducted in accordance with proper training & guidelines defined in the current Pilot Operating Handbook and/or Flight Training Supplement for this Aircraft.

End Appendix C End POH & FTS

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Appendix D – Bailey Release and Tow System

Operating Instructions of Bailey Tow Release System

1. General Information

1.1 Introduction

The Bailey Release and Tow System has been used and refined since 1990 on the Bailey Moyes Dragonfly for towing Hang Gliders, Ultralight Gliders and Light Sailplanes. This is more than a Release , it is a complete System. Comprised of key elements protecting both the Tow Plane and the Craft being towed. The Bridle and Slider, which is unique in the Dragonfly Aero-Towing community, allows more pitch control of the Tow Plane during towing. This combined with proven application of the Safety Link in the Bridle protects the maneuverability and structure of the Tow Plane.

1.2 Warnings, Cautions and Notes Explained:

WARNING: Denote items where Person Protective Equipment (PPE) is required when working on the system components.

CAUTION: Denote items pertaining to safety that may be easily overlooked and may need double checking.

NOTE: Items of particular interest or must be Inspected during routine maintenance and inspection.

1.3 Description of Bailey Release and Tow System

The Bailey Tow and Release System has a release similar to the "Schweizer Release" but also incorporates special aspects such as the Bridle, Slider and Safety Links in key locations which afford the maximum amount of maneuverability and safety to the tow plane & pilots of both craft. For this reason we consider it a Complete System rather than just a release mechanism.

1.4 Perspective Views and Photos

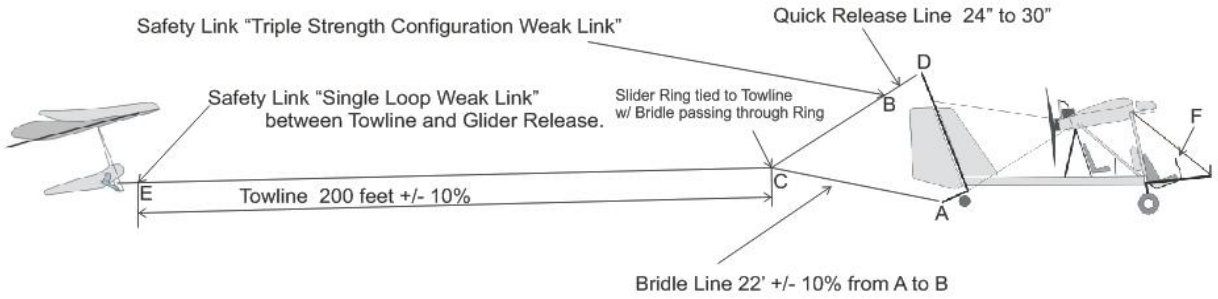


FIGURE 1 (Bailey Release & Tow System Configuration)

CAUTION: Any increase in Safety Link strength or change of configuration may cause structural damage and/or allow either or both aircraft to get into unsafe attitudes. Safety Links must be installed in the configurations outlined within!

Figure A: Bailey Release Mechanism

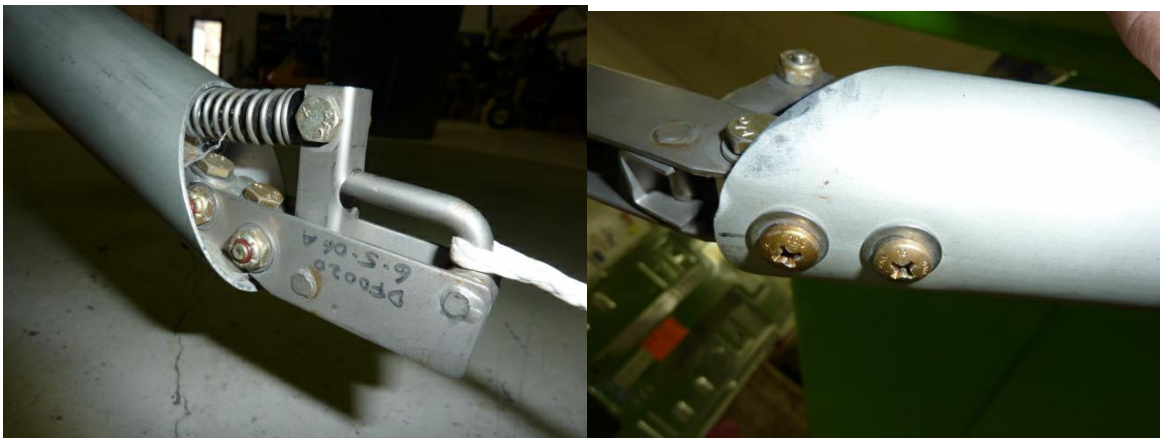
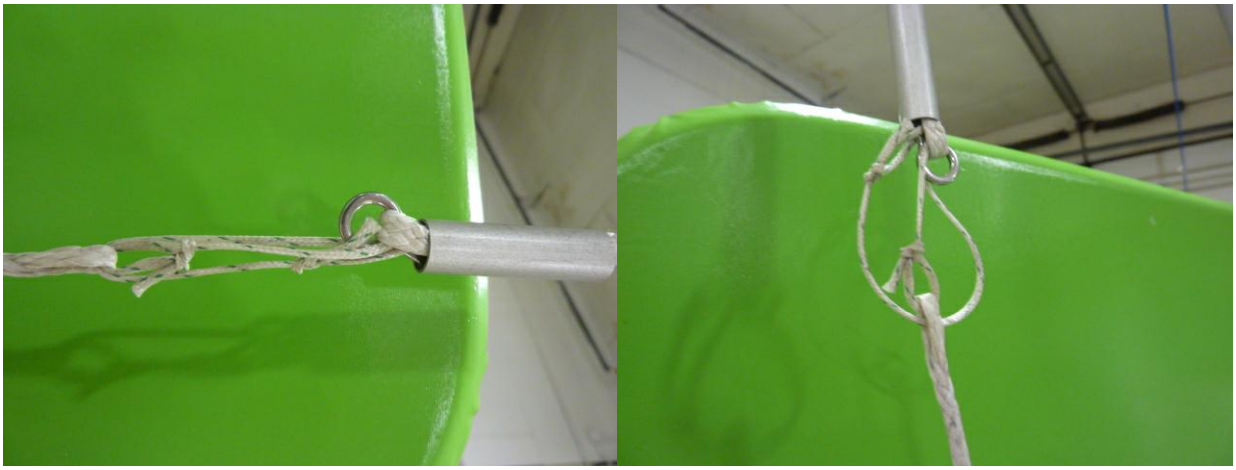


Figure B: Quick Release and Safety Link



Quick Change Pin and Retainer showing configuration of Safety Link.
Option A has Triple Strength Configuration shown in Figure 2, to give 3 strands of 130 lb. line Safety Link connecting bridle to towline.
Option B has Single Loop of 200 Lb. line not doubled. This provides 2 strands of 200 lb. Safety Link carrying the loads.

Figure B-2 Bridle Quick Change Link

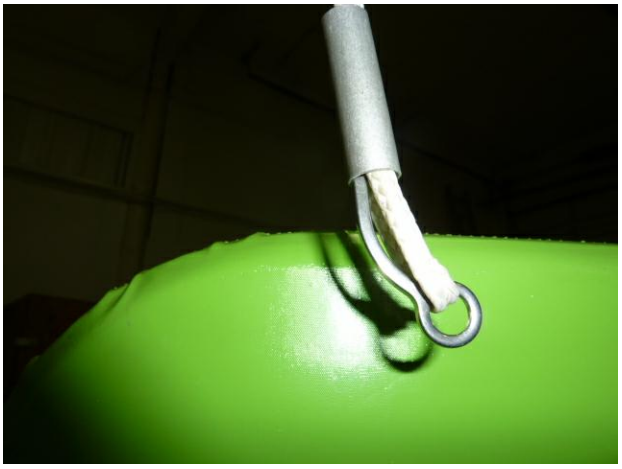


Figure C: Slider Ring or Karabiner

Figure D: Top Post Quick Change Line Retainer and Simple Knot.

Simple Granny Knot with tail tucked in tube ahead of Knot

Figure E: Small Karabiner or Ring with Funnel Device for wind resistance and additional drag to make the untethered line fly higher behind the Tow Plane. It also protects the Ring attachment line.

Rings or Karabiner are attached with line passed through loop and pulled snug.

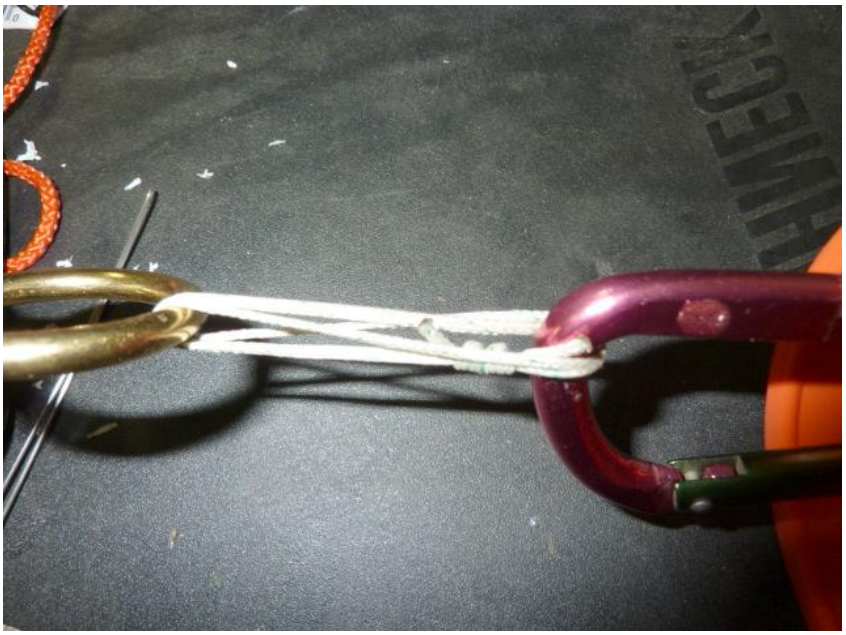


Figure E 2 Single Point Glider Attachment, picture shows Single Loop Doubled to give 4 strands of 130 lb. Safety Link connecting tandem glider to towline.

Figure E 3 2 Point Glider Attachment, picture shows a Single Loop Safety Link of 130 lb. Solo or 200 lb. Tandem, attached by passing it through itself and attaching to Glider Release. This provides 2 strands of Safety Link carrying the loads.

CAUTION: Any increase in Safety Link strength or change of configuration can cause structural damage and/or allow either or both aircraft to get into unsafe attitudes. Safety Links must be installed in the configurations outlined within!

Figure E 4 3 Point Glider attachment

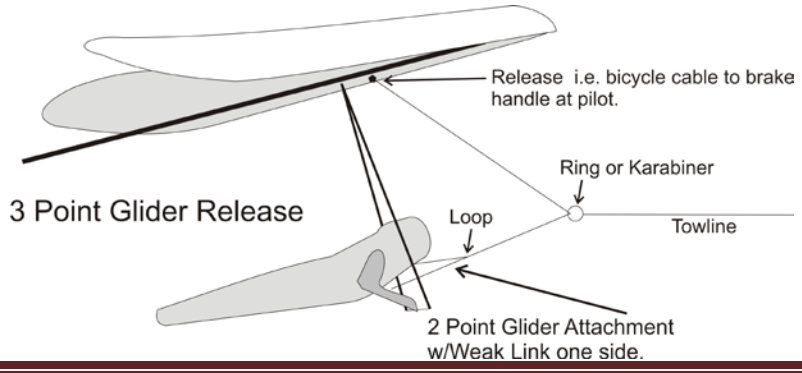
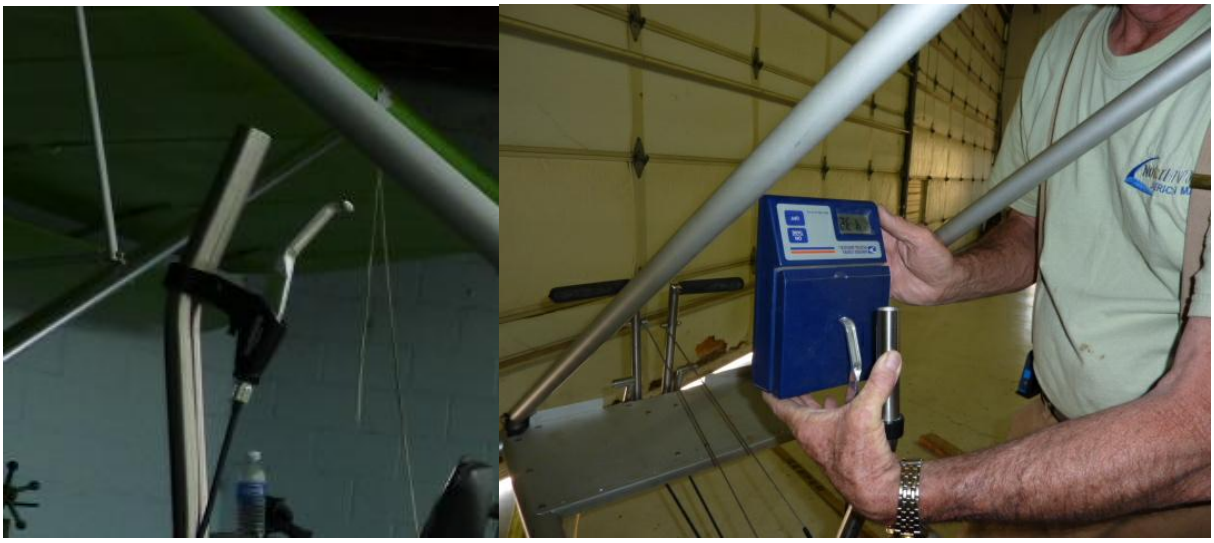

Release i.e. bicycle cable to brake handle at pilot.
Ring or Karabiner
3 Point Glider Release
Loop
Towline
2 Point Glider Attachment w/Weak Link one side.

Figure F: Release Handle



Release Pressure is easily measured with a Digital Postal Scale. Normally 5 lb. 4 oz. 4 to 9 lbs. of pressure are acceptable. More than 9 lbs. pressure indicates cable needs replacement or there is excessive resistance somewhere in the system.

2. Limitations

2.1 Introduction

It is important to adhere to the specifications for Installation, Maintenance and Inspection that have been tested, refined and proven since 1990. This information is found in the Dragonfly Maintenance Manual and Pilot Operating Handbook (POH) . In order to confirm you have the most current information, consult manuals posted on the website at: www.pitmanair.com/dragonfly

Operating Limitations:

1) V_T (Maximum Towing Speed) 50 mph
2) Maximum Weak Link Strength* 200 Lbs. (* Must only be used as defined in Section 2.3 of this Appendix)
3) Maximum all up weight of glider to be towed 562 Lbs

2.2 Installation

Installation and Maintenance are defined in the Dragonfly Maintenance Manual.

2.3 Loads

Maximum gross vehicle weight to be towed: 562 lbs. (255 Kg.)
Loads are limited by proper installation and used of "Safety Links" commonly referred to as Weak Links.
Safety Links are made from 130 lb. or 200 lb. Braided Dacron Fishing Line depending upon placement and loads.

The Single Loop is used to fasten the Towline to the Glider being towed. (Point E in Figure 1)
Solo Glider **TUF LINE BRAIDED DACRON 130 LB. TEST GREEN SPOT,** or
Tandem Glider **TUF LINE BRAIDED DACRON 200 LB. TEST GREEN SPOT, (200 lb. on Single Loop only)**
which can be purchased on the Internet.

The Triple Strength Link is used to fasten the Tow Bridle to the Quick Release. (Point B in Figure 1)
We use TUF LINE BRAIDED DACRON 130 LB. TEST GREEN SPOT, or
TUF LINE BRAIDED DACRON 200 LB. TEST GREEN SPOT, (200 lb. on Single Loop only)

CAUTION: Any increase in Safety Link strength or change of configuration can cause structural damage and/or allow either or both aircraft to get into unsafe attitudes. Safety Links must be installed in the configurations outlined within!

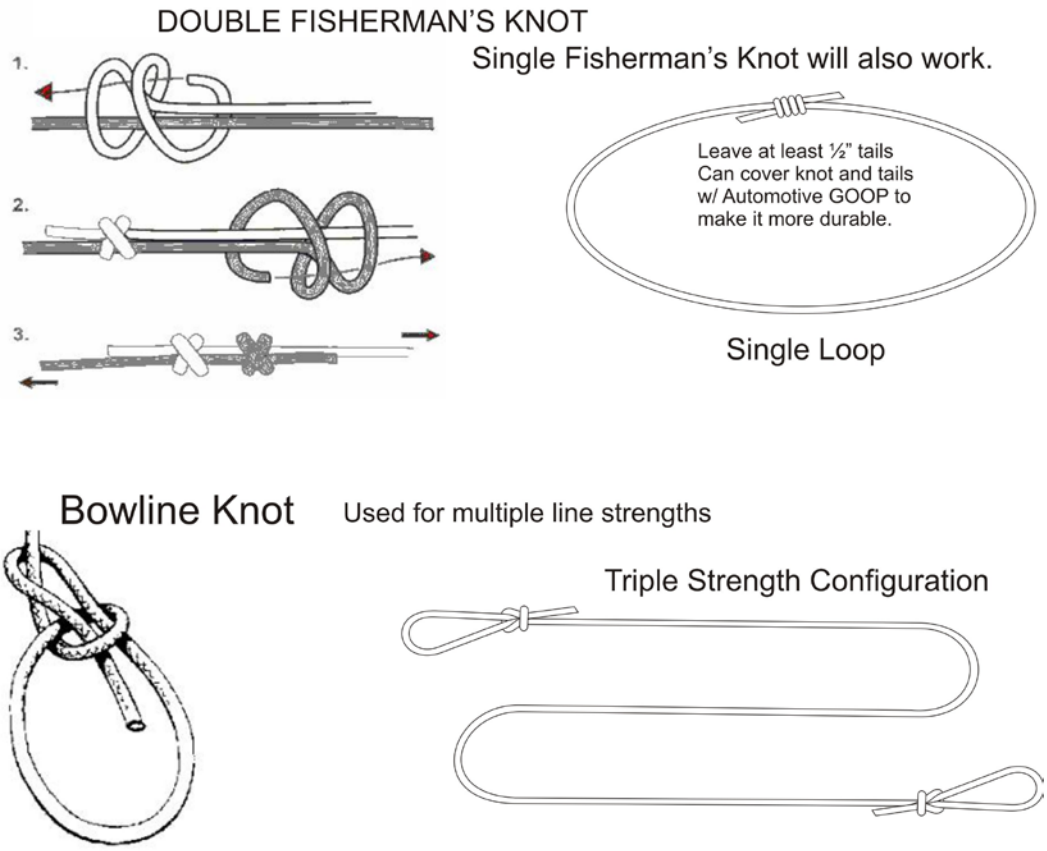


FIGURE 2 Knots used for Safety Links

CAUTION: Any increase in Safety Link strength or change of configuration can cause structural damage and/or allow either or both aircraft to get into unsafe attitudes. Safety Links must be installed in the configurations outlined within!
NOTE: Automotive GOOP can be applied over knots to help them last longer.

The Tow System, Release and Airframe have been tested in accordance with AC 43.13-2B Chapter 8 804 (d) 1, 2 & 3

NOTE: This Placard must be in the Cockpit and view of the Tow Pilot. " Glider towline assembly Safety Link breaking strength not to exceed 130 lbs. and tied in the manner specified in the manuals." and "Banner towing is excluded by the Light Sport Rule." (AC 43.13-2B 807)
NOTE: Placard in Cockpit to indicate Release operation. "Emergency Release, Squeeze Lever to Release Towline."

2.4 Angles
Angles tested in accordance with AC 43.13-2B 806 and additionally to a 33 degree cone of forces.

2.5 Forces
Forces to the Aircraft structure are limited by the Safety Links. These have been tested in both slow application and quick application of forces.
Tested in the cone of forces to 675 lbs. in accordance with AC 43.13 – 2B 804 d (1)

2.6 Specifications

2.6.1 Tow Lines and Safety Links.

Towlines and Bridle are made of Spectra 1000 or Dyneema (UHMwPE). 1100# to 2200# due to the dragging of the line during landing and taxi we use a more durable line. The small diameter and light weight of the towline, allows it to maintain alignment with less effect from wind & gravity forces. There is almost zero plasticity allowing all forces to get to the Safety Links rapidly.

CAUTION: Never use twisted construction lines or rope. Always use Braided construction lines as specified in Dragonfly Manuals.
NOTE: Because of the durable size of the line, it is important to insure Safety Links are properly installed. Refer to FIGURE 2 for proper tying and configuration

Weak Links:
The Single Loop is used to fasten the Towline to the Glider being towed. (Point E in Figure 1)
Solo Glider **TUF LINE BRAIDED DACRON 130 LB. TEST GREEN SPOT,** or
Tandem Glider **TUF LINE BRAIDED DACRON 200 LB. TEST GREEN SPOT, (200 lb. on Single Loop only)**
which can be purchased on the Internet.

The Triple Strength Link is used to fasten the Tow Bridle to the Quick Release. (Point B in Figure 1)
We use TUF LINE BRAIDED DACRON 130 LB. TEST GREEN SPOT,

NOTE: Automotive GOOP can be applied over knots to help them last longer.

2.7 Period of Operations of Release, TBO and Inspection Intervals.

Normally at engine change or rebuild, approximately 2000 hours or 6,000 tows, a complete and thorough inspection of the release should be performed. There is no specific TBO. However, every Annual or 100 Hour Inspection requires a thorough inspection to insure there are no problems with wear or operation of the Release and all components in the Tow Release and System.

There are Releases in operation that are more the 20 years old and are still in good working condition. Some older units had a zinc plated steel spring that eventually corrodes. But the newer Stainless Steel Spring has shown no signs of problems. We have never experienced a broken spring in 20+ years, but it must be inspected every Annual or 100 Hour Inspection.

3. Checklists

3.1 Pre-Flight (second person needed)

1) Visually inspect all components and lines.
2) Inspect Release Mechanism
3) Without pressure on Bridle, insure Release Locking Arm on Release Assembly and Handle return to Normal Positions.
4) With pull being applied to bridle, test that line releases properly and with smooth motion of the release handle.
5) Insure that Safety Links are proper size, material and installed properly. Links are in good condition. Both the Bridle Safety Link and Safety Links to be used on the glider end.

3.2 Pre-Tow

1) Insure that Pilots, Ground Crew and Helpers have the proper Ratings, Authorizations, Waivers and Experience necessary to conduct Safe Operations.
2) Insure that all Ground and in-flight signals and communications between Tow Plane Pilot, Glider Pilot and Ground Crew are agreed upon and everyone involved knows these signals and there will be no confusion during operations.
3) Insure that Ground Crew and Bystanders are aware of the Safety Practices and Safe Zones during Tow Operations.

3.3 Post-Flight

1) Conduct the Pre-Flight Inspection to see if maintenance is needed before next operation.

4. Maintenance and Service

4.1 General

Proper Service and Maintenance of the Tow and Release System is critical to Safe Operations. Safety Links in prescribed configurations protect the airframe structure from excessive forces.

4.2 Installation

Installation must be in accordance with the current Dragonfly Maintenance Manual. Available for download at: www.pitmanair.com/dragonfly

4.3 Inspections

NOTE: Daily Inspection & Preflight Inspection are the same.

A) Pre-flight (second person may be needed)

1) Visually inspect all components and lines.
2) Inspect Release Mechanism
3) Without pressure on Bridle, insure Release Locking Arm on Release Assembly and Handle return to Normal Positions.
4) With pull being applied to bridle, test that line releases properly and with smooth motion of the release handle.

5) Insure that Safety Links are proper size, material and installed properly. Links are in good condition. Both the Bridle Safety Link and Safety Links to be used on the glider end.

B) Every 100 Hours or Annual Inspection, whichever occurs first.

1) Inspect for excessive wear or binding in the system.
2) Inspect the Release Handle Cable Housing for cracks which would indicate deterioration of the cable housing.
3) Insure that the Release Handle Pressure measured at the top of the handle does not exceed 8 lbs..
4) Insure that the cable moves freely through the cable housing and returns to the normal position by release spring pressure only.
5) Insure that the release L link has not developed a wear notch. This notch can be smoothed with a file. But do not remove more than 10% of the material on the L link, and insure that it maintains the round shape that matches the Release Arm.
5) Inspect all fasteners for proper torque.
6) Inspect all lines for excessive wear, fraying, kinks or knots than would weaken the line.
7) Insure slider has not developed wear spots or sharp edges that would cut or bind the line.
8) Replace any parts that exhibit excessive wear, friction or damage, in accordance with the Maintenance Manual and use only factory replacement parts.

4.4 Operational Tests

1) Without pressure on Bridle, insure Release Locking Arm on Release Assembly and Handle return to Normal Positions.
2) With pull being applied to bridle, test that line releases properly and with smooth motion of the release handle.
3) Insure that Safety Links are proper size, material and installed properly. Links are in good condition. Both the Bridle Safety Link and Safety Links to be used on the glider end.

4.4.1 Operational Forces

Operational Forces are limited by the Safety Links.

CAUTION: Proper materials and installation of Safety Links are required.

4.5 Corrosion, Wear and Breakage

The components in the Bailey Release and Towing System are made of materials that resist corrosion. Any excessive Corrosion, Cracks, Breakage or Wear of parts or assemblies, requires replacement of bad parts or assemblies with factory supplied parts or assemblies. Refer to Dragonfly Maintenance Manual.

4.6 Care and Cleaning

The components of the Tow and Release System should be kept Clean and free of dirt and sand. There should be no need for lubrication. If lubrication is applied it should be Dry Lubricant as specified in the Dragonfly Maintenance Manual in order to prevent the accumulation of dirt and dust.

4.7 Tow Lines and Safety Links (Weak Links).

Towlines and Bridle are made of Spectra 1000 or Dyneema (UHMwPE). 1200# +/- 20% due to the dragging of the line during landing and taxi we use a more durable line. The small diameter and light weight of the towline, allows it to maintain alignment with less effect from wind & gravity forces. There is almost zero plasticity allowing all forces to get to the Safety Links rapidly.

NOTE: Because of the durable size of the line, it is important to insure Safety Links are properly installed.

CAUTION: Loads are limited by proper installation and used of “Safety Links” commonly referred to as Weak Links. Refer to FIGURE 2 for proper tying and configuration.

The Single Loop is used to fasten the Towline to the Glider being towed. (Point E in Figure 1)
Solo Glider **TUF LINE BRAIDED DACRON 130 LB. TEST GREEN SPOT,** or
Tandem Glider **TUF LINE BRAIDED DACRON 200 LB. TEST GREEN SPOT, (200 lb. on Single Loop only)**
which can be purchased on the Internet.

The Triple Strength Link is used to fasten the Tow Bridle to the Quick Release. (Point B in Figure 1)
We use TUF LINE BRAIDED DACRON 130 LB. TEST GREEN SPOT,

NOTE: Automotive GOOP can be applied over knots to help them last longer.

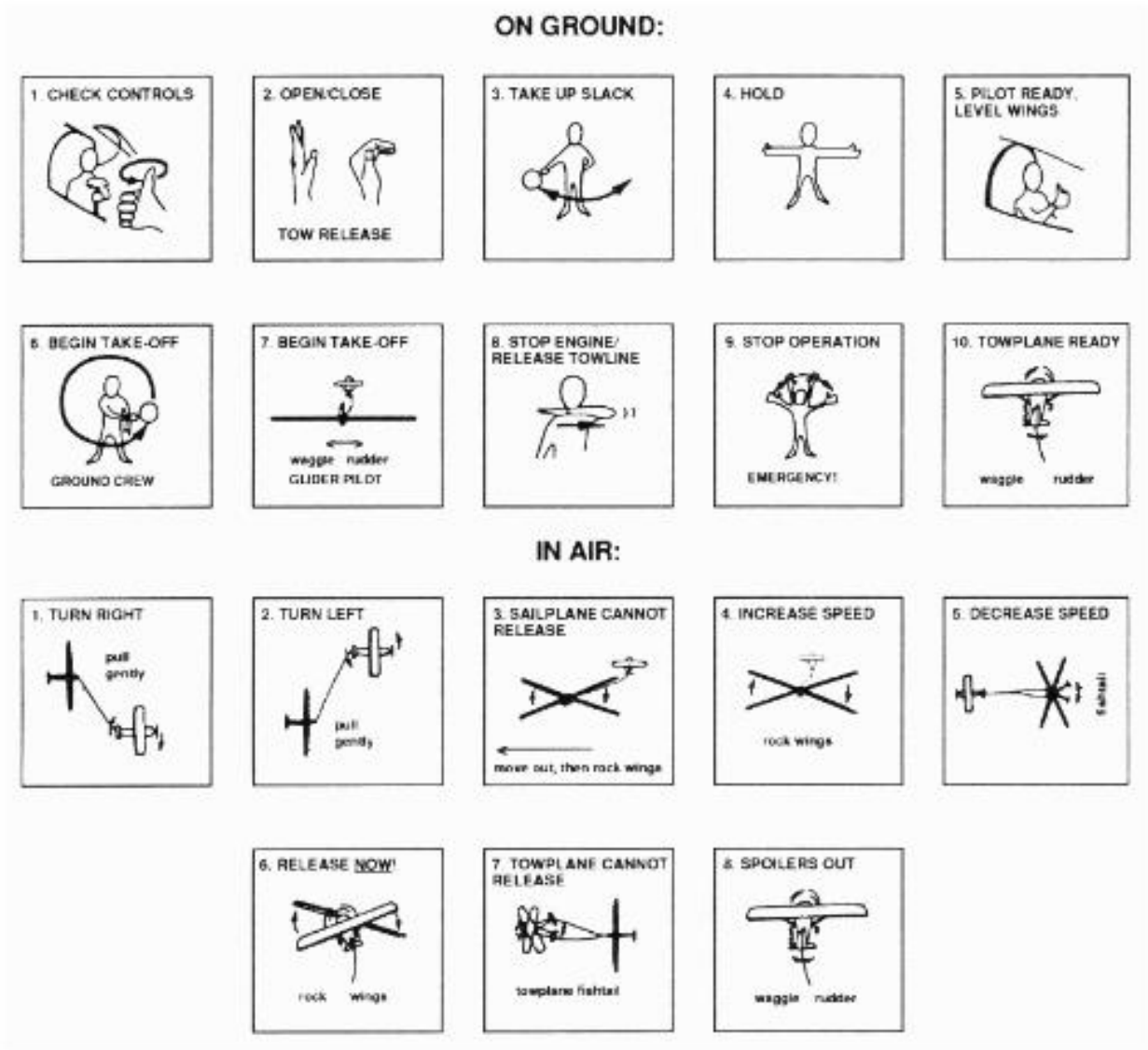
5. Signals and Communications for Tow Operations

5.1 Introduction

In accordance with 91.309 (5) General course of action, including takeoff and release signals, airspeeds, and emergency procedures for each pilot.)

5.2 Hand, Arm and Rudder Signals

NOTE: These are simply examples. The most important aspect of signals, is that everyone involved in tow operations knows, understands and uses the same set of signals!



By Memphis Soaring

FIGURE 3 Common Signals

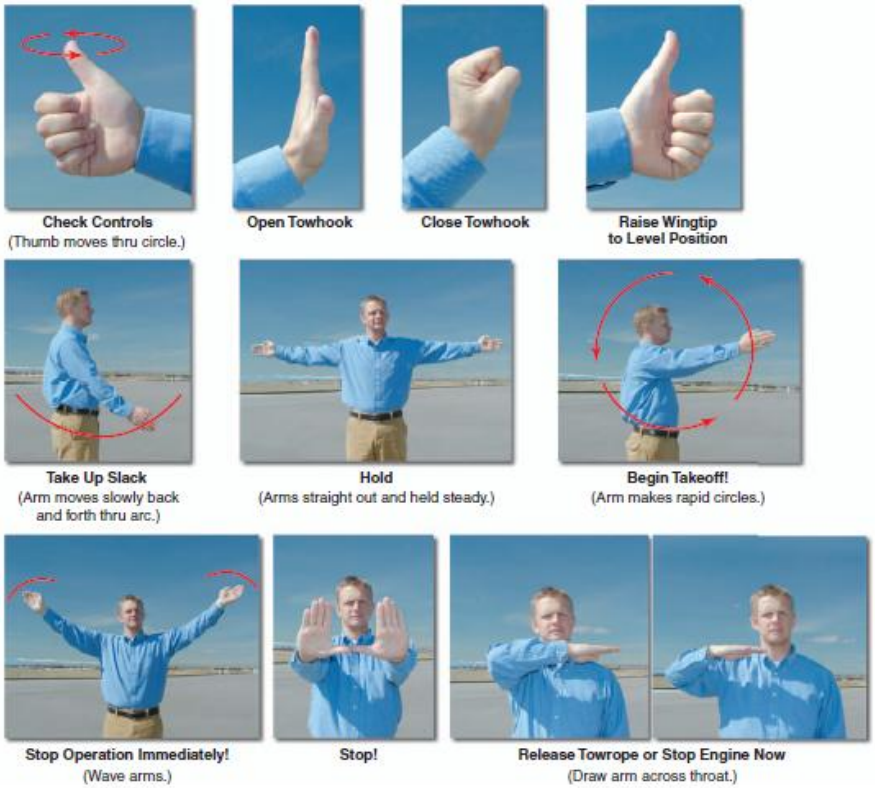


FIGURE 4 Common Arm and Hand Signals *By Evergreen Soaring*

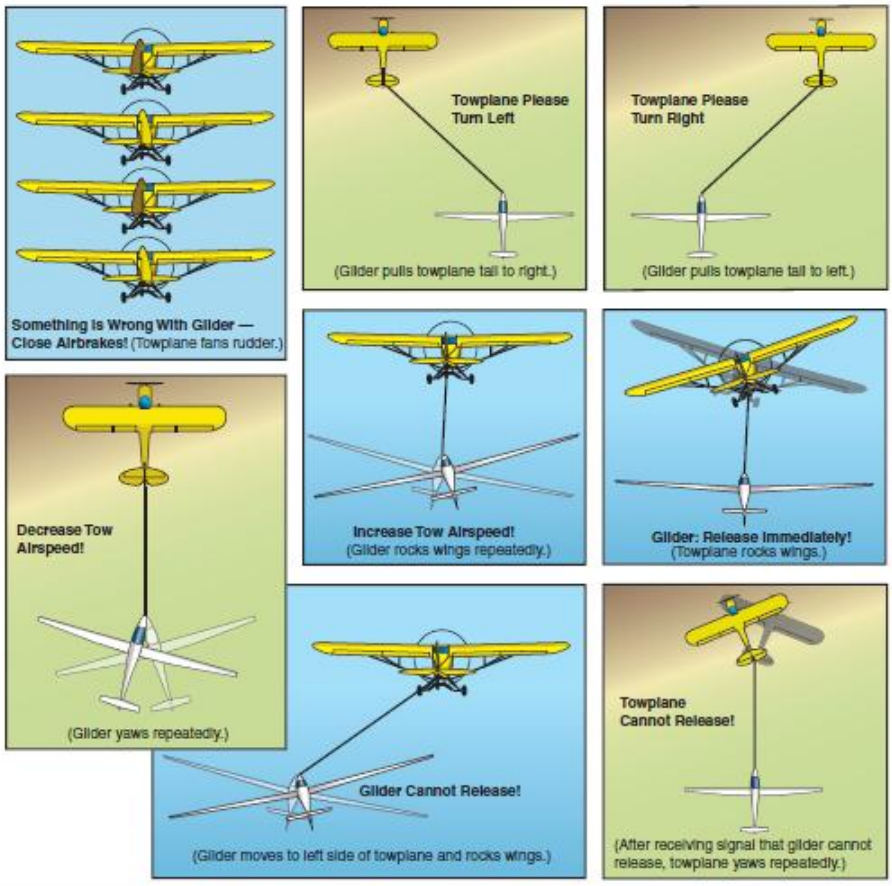


FIGURE 5 Common Aircraft Signals *By Evergreen Soaring*

5.3 Radio Communications

Radio Communications are usually plain language. However, radio communications should always be accompanied by Arm, Hand and Aircraft Action & Control Surface Signals! All persons involved in the Tow Operations must understand and use the same set of signals.

6. Safety Bulletins

Safety Bulletins for the Bailey Release and Tow System can be found on the Dragonfly website at: www.pitmanair.com/dragonfly

CAUTION: Safety Bulletins will contain important information and instructions for safety and compliance.

7. Operational and Service Difficulty Reporting

7.1 Introduction

Operational Safety is dependent on reporting anomalies and complying with Safety Bulletins. This information is available for all on the Pitman Air website. www.pitmanair.com/dragonfly

7.2 Registration in Dragonfly and Bailey Release and Tow System Safety Information Network.

Original Owners of the Bailey Moyes Dragonfly by Pitman Air are automatically included in the information network. Owners of SLSA are required to inform Pitman Air or the Continued Airworthiness Authority of any change of address or contact information within 30 days of such changes. If the unit is sold, the new Owner must inform Pitman Air of the new contact information as soon as possible.

NOTE: Experimental Dragonfly Aircraft that transitioned from Ultralights, may take advantage of the Tow System Authorization or Waiver, by maintaining their Aircraft and Tow System in accordance with the Maintenance and Service Instructions contained in the Dragonfly Maintenance Manual and Pilot Operating Handbook (POH) posted on the web at: www.pitmanair.com/dragonfly

Any Changes, Alterations or Repairs not specifically covered in the Dragonfly Maintenance Manual, REQUIRES a Letter of Authorization (LOA) from Pitman Air.

NOTE: SLSA aircraft must have an LOA "Letter of Authorization" from Pitman Air for Alterations and/or Modifications in the aircraft records to maintain their Special Airworthiness Status. Failure to do so may cause the Airworthiness status to revert to Experimental.

7.3 Operational and Service Difficulty Reporting Form

The Maintenance Manual and Pilot Operating Handbook for the Bailey Moyes Dragonfly by Pitman Air contain a "Safety of Flight & Service Difficulty Report Form" in the back of the manual.

NOTE: Reporting of such difficulties is mandatory for SLSA and Kit ELSA produced by Pitman Air. In order to be included in the Dragonfly Network and Safety Bulletin network for a Transitioned ELSA and have the Tow System Authorization, the Dragonfly owner must contact Pitman Air and conform to the maintenance requirements outlined in the current manuals. And the Aircraft must be registered in the United States.

End Appendix D

Appendix E Aero Tow Exemption

Exemption No. 11104

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, DC 20591

In the matter of the petition of

PITMAN AIR, LLC

for an exemption from §§ 91.309(a)(2) and 91.309(a)(3) of Title 14, Code of Federal Regulations

Regulatory Docket No. FAA 2013-0508

GRANT OF EXEMPTION

By letter dated June 7, 2013, Mr. Edgar D. Pitman, Member, Pitman Air LLC, 1840 Airport Blvd, Red Bluff, CA 96080 petitioned the Federal Aviation Administration (FAA) on behalf of Pitman Air, LLC (Pitman) for an exemption from §§ 91.309(a)(2) and 91.309(a)(3) of Title 14 Code of Federal Regulations (14 CFR). The proposed exemption, if granted, would allow Pitman to utilize the Bailey Tow & Release System on the Dragonfly Light Sport Aircraft.

The petitioner requests relief from the following regulations:

Section 91.309(a)(2) prescribes, in pertinent part, that no person may operate a civil aircraft towing a glider or unpowered ultralight vehicle unless— The towing aircraft is equipped with a tow-hitch of a kind, and installed in a manner, that is approved by the Administrator; and

Section 91.309(a)(3) prescribes, in pertinent part, the towline used has breaking strength not less than 80 percent of the maximum certificated operating weight of the glider or unpowered ultralight vehicle and not more than twice this operating weight. However, the towline used may have a breaking strength more than twice the maximum certificated operating weight of the glider or unpowered ultralight vehicle if—

(i) A safety link is installed at the point of attachment of the towline to the glider or unpowered ultralight vehicle with a breaking strength not less than 80 percent of the

AFS-13-411-E

maximum certificated operating weight of the glider or unpowered ultralight vehicle and not greater than twice this operating weight;

(ii) A safety link is installed at the point of attachment of the towline to the towing aircraft with a breaking strength greater, but not more than 25 percent greater, than that of the safety link at the towed glider or unpowered ultralight vehicle end of the towline and not greater than twice the maximum certificated operating weight of the glider or unpowered ultralight vehicle;

The petitioner supports its request with the following information:

The petitioner states that, an exemption from §§ 91.309(a)(2), 91.309(a)(3) would allow the towing aircraft to perform tow functions with a Bailey Tow and Release System, without meeting the requirement of being equipped with a tow-hitch of a kind, and installed in a manner, that is "approved by the Administrator". This exemption specifically applies to the Pitman Air, Dragonfly Aircraft certificated as Special Light Sport Aircraft (SLSA) and Dragonfly Aircraft certificated as Experimental Light Sport Aircraft (ELSA). The petitioner also states the SLSA and the ELSA Dragonfly aircraft are built and maintained in accordance with Pitman Air Dragonfly Maintenance and Inspection procedures.

The petitioner is requesting this exemption include owners of ELSA Dragonfly aircraft. The owners would be offered inclusion in this exemption, provided they agree to maintain their aircraft and the Bailey Tow and Release System in accordance with SLSA Dragonfly requirements. They must also agree to participate in the Continued Operational Safety Monitoring System for the Dragonfly SLSA, offered by Pitman. Pitman will require the included ELSA Dragonfly owners to pay a fee for this administrative and monitoring process.

A summary of the petition was published in the Federal Register on September 2, 2014 (79 FR 52104). No comments were received.

The FAA's analysis is as follows:

The FAA finds that this exemption only applies to §§ 91.309(a)(2) and 91.309(a)(3) relief being sought, it does not apply to the non-regulatory request submitted by the petitioner.

The FAA finds that the tow and release assembly on Light Sport Aircraft (LSA) must be approved by the Administrator as specified by §§ 91.327(a)(1) and 91.319(e)(1) as applicable. However, LSA are built to a FAA accepted standard owned by the American Society for Testing and Materials (ASTM), therefore the Dragonfly LSA certificated under §§ 21.190 or 21.191(i)(1) as applicable, are termed as FAA accepted and not FAA approved. The tow system must be manufactured and approved by the aircraft manufacturer in accordance with ASTM standard F2245, Annex A1.

The information in the Dragonfly LSA maintenance manual and pilot operating handbook (POH) must meet the requirements of ASTM standard F2245, Annex A1.1 through A1.7, when the aircraft is equipped for towing.

The Bailey Tow & Release System in this case may be accepted by the FAA if built to the applicable ASTM standards and is approved for installation by the LSA manufacturer. A grant of exemption from §§ 91.309(a)(2), (a)(3)(i) and (ii) would provide relief to the owners of the Dragonfly LSA from the regulatory requirement of having the tow and release assembly approved by the Administrator as required by§§ 91.327(a)(1) and 91.319(e)(1).

The FAA will not mandate owners and operators who opt to utilize the Bailey Tow and Release System to participate in the Continued Operational Safety Monitoring System for the Dragonfly SLSA and ELSA offered by Pitman Air, LLC. Also, we will not require the owners and operators of the Dragonfly SLSA and ELSA to pay a fee for administrative and monitoring services. These requests by Pitman Air, LLC are non-regulatory and will not be addressed by this exemption request.

The FAA's Decision

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 106(f), 40113 and 44701 delegated to me by the Administrator, Pitman Air, LLC is granted an exemption for the Bailey Tow & Release System from §§ 91.309 (a)(2) and 91.309(a)(3) of Title 14 Code of Federal Regulations to the extent necessary for owners of the Dragonfly SLSA and ELSA aircraft certificated under §§ 21.190 and 21.191(i)(l), manufactured by Pitman Air LLC, equipped with the Bailey Tow & Release System to tow aircraft and be in compliance with the issued operation limitations under §§ 91.327(a)(1) and 91.319(e)(1) as applicable. Operators of the Dragonfly aircraft that opt to utilize the Bailey Tow and Release System on their Dragonfly aircraft must follow the Conditions and Limitations of this exemption, subject to the conditions and limitations listed below.

Conditions and Limitations

1. The owner/operator will utilize the Bailey Tow and Release System only on the Pitman Air Dragonfly Light Sport Aircraft certificated under §§ 21.190 and 21.191(i)(1) of Title 14 Code of Federal Regulations.
2. The owner/operator will maintain and operate the tow hook assembly utilizing the Operation, Maintenance & Inspection Instructions for the Bailey Tow and Release System.
3. The information in the Dragonfly LSA maintenance manual and pilot operating handbook (POH) must meet the requirements of ASTM standard F2245 Annex A1.1 through A1.7, when the aircraft is equipped for towing
4. For tow operations, the Light Sport Aircraft operator must meet the 100 hour inspection requirements of §§ 91.319(g)(1) or (g)(2), or 91.327 (c)(1) or (c)(2), of Title 14 Code of Federal Regulations as certificated.

5. A copy of this exemption must either be incorporated into the aircraft pilot operation handbook (POH) or carried on the aircraft while operating under this exemption.

This exemption terminates on November 30, 2016 unless sooner superseded or rescinded.

Issued in Washington, DC, on November 18, 2014.

Michael J. Zenkovich
Deputy Director, Flight Standards Service

Appendix F Aerobatic Training Syllabus

Typical Dragonfly Aerobatics Training Syllabus

Note: This is a sample Syllabus used by Factory Test Pilots when teaching Aerobatics in the Dragonfly. These maneuvers should not be attempted without Proper Training.

Accelerated Stalls

1) Enter a level turn while slowly increasing bank angle at 1.2 Vso

2) When aircraft has stalled (at approx.. 45 degree bank) Then, release back pressure on the control stick lowering the angle of attack, correcting back to level flight.

Common problems with coordinated accelerated stalls:

1) Entry Speed too high or too low
2) Unable to maintain altitude – nose too high – nose too low
3) Unable to apply enough back pressure to the stick

Accelerated Stalls – Top Rudder

1) Enter a level turn while slowly increasing bank angle at 1.2 Vso, But this time maintaining a skidding condition using rudder pressure opposite the turn.
2) When aircraft has stalled (asymmetrically) , then release back pressure on the stick while releasing pressure on the rudder followed by a mild correction to level flight.

Common Problems:

1) Entry speed too high or too low
2) Unable to maintain altitude
3) Unable to apply enough back pressure
4) Unable to maintain rudder pressure to the point of stall

Accelerated Stalls- Bottom Rudder – Spin Entry

1) Enter a level turn while increasing bank angle at 1.2 Vso, this time maintaining a skidding condition using rudder pressure into the turn.
2) When aircraft has stalled (asymmetrically) then release back pressure on the stick while releasing pressure on the rudder, reduce power to idle and roll wings level while the nose is raised to level flight.
3) Then back to cruise power.

Common Problems:

1) Entry speed too high or too low.
2) Unable to maintain altitude.
3) Unable to apply enough back pressure
4) Unable to maintain rudder pressure to point of stall.
5) Reduce power when required.

Spin Entry – Spins (Nose Down)

1) From cruise, reduce Power to idle
2) Maintain Altitude to Vs, then at Vs apply full rudder and full up elevator using full back stick
3) Check for pivotal rotation, establish reference (ground, sky, sun,) then count rotaions.

Spin Recovery – Exit (for nose down spins)

1) Release back pressure while rudder pressure is released to stop pivotal rotation
2) Recover from nose down attitude to level flight and then cruise power.

Common Problems
1) Not holding stick all the way back
2) Identify pivotal rotation vs Spiral (no Spiral)
3) Awareness of altitude
4) Loss of Orientation (spin reference)
5) Too aggressive during the nose up recovery causing excessive loads.
6) Too slow raising the nose during recovery causing excessive speed.
7) Applying Aileron control in the direction of the spin during spin entry.

Flat Spin Entry

Initiate with Normal Spin Entry

1) From Cruise, reduce power to idle.
2) Maintain altitude to Vs. then at Vs apply full rudder
3) Check for pivotal rotation and establish reference (ground, sky, sun) then count rotations
4) Immediately after ¼ (one quarter) rotation apply aileron opposite to rotation (rudder) while still holding full rudder and full up elevator using full back stick.
5) At this point a bank change opposite of spin rotation occurs until spin rate increases.
6) Next, rotation rate increases and descent rate decreases while the nose raises to a flat level attitude.
7) Rotation rate is easily controlled at this time using aileron deflection and will remain flat in a range from approximately ½ (one half) stick aileron deflection to full deflection. With full deflection resulting in a rate that can be uncomfortable.

Flat Spin Recovery

1) As with most aircraft initiate by releasing back pressure on the stick.
2) Neutralize ailerons to center the stick, using light pressure (less than 2 pounds).
3) Neutralize rudder using moderate pressure.
4) As rotation rate slows the nose will lower itself until rotation stops and normal airspeed is regained and can return to level flight.

Note: At 1080 lbs. (Gross Weight) and maximum aft CG 80.78", Dragonfly Flat Spin Recovery by itself with zero control pressures, (i.e. let go of the controls) in less than 3 rotations. If neutral rudder and aileron are used this is reduced to 2 ¼ rotations.
At 690 lbs. gross (solo), and CG at 79.3" Dragonfly Flat Spin Recovery by itself without help is 1 (One) rotation.

The Dragonfly w/912 and average solo pilot weight, takes approximately 1 ½ (one and one half) rotations generally.

End of Appendix F

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Pitman Air Bailey Moyes Dragonfly Aircraft Acceptance Checklist

Owner Name:_____Phone:_____

Address:_____City:_____State:_____Zip:_____

Serial # _____N-Number:_____ Delivery Date:_____

Delivery Location _____

			Check O when accepted
1.	**Aircraft Documents**	**Accepted**	**O**
2.	**Engine Logbook Serial #_____**	**Accepted**	**O**
3.	**Aircraft Manuals POH, Maint. Manual**	**Accepted**	**O**
4.	**Equipment Manuals in POH, Maint. Manual**	**Accepted**	**O**
5.	**Ballistic Chute Operation & Service explained**	**Accepted**	**O**
6.	**Electrical switches Circuit breakers Master switch**	**Accepted**	**O**
7.	**Basic instruments and their operation**	**Accepted**	**O**
8.	**Fuel shutoff and ignition switch**	**Accepted**	**O**
9.	**Wing attach points**	**Accepted**	**O**
10.	**Baggage location & limitations**	**Accepted**	**O**
11.	**Flight control visual inspection**	**Accepted**	**O**
12.	**ELT and remote operation**	**Accepted**	**O**
13.	**Main Landing Gear**	**Accepted**	**O**
14.	**Ballistic chute blowout panel**	**Accepted**	**O**
15.	**Antenna**	**Accepted**	**O**
16.	**Airframe construction, inspection and care**	**Accepted**	**O**
17.	**Vertical stabilizer and lower fin**	**Accepted**	**O**
18.	**Airframe Identification Plate**	**Accepted**	**O**
19.	**Trim Operation**	**Accepted**	**O**
20.	**Flight control push-pulls, cables and balance weight**	**Accepted**	**O**
21.	**Rudder and ground steering operation**	**Accepted**	**O**
22.	**Aileron Characteristics**	**Accepted**	**O**
23.	**Pitot tube**	**Accepted**	**O**
24.	**Fueling aircraft & Fuel cap/vent characteristics**	**Accepted**	**O**
25.	**Wing-root seal**	**Accepted**	**O**
26.	**Engine Fasteners**	**Accepted**	**O**
27.	**Tail Wheel assembly and rigging**	**Accepted**	**O**
28.	**Exhaust**	**Accepted**	**O**
29.	**Propeller Serial #_____**	**Accepted**	**O**
30.	**Engine intake filters & radiator**	**Accepted**	**O**
31.	**Oil & checking the oil mix**	**Accepted**	**O**
32.	**Coolant**	**Accepted**	**O**
33.	**Fuel Strainer**	**Accepted**	**O**

34. Seat & rear strap operation	**Accepted**	**O**
35. Back Seat & Side Storage & Seat belts	**Accepted**	**O**
36. Fuel system	**Accepted**	**O**
37. Engine controls	**Accepted**	**O**
38. Flight controls	**Accepted**	**O**
39. Trim controls	**Accepted**	**O**
40. Brake system	**Accepted**	**O**
41. Filling tires	**Accepted**	**O**
42. No step areas	**Accepted**	**O**
43. Cleaning and Care (no alkaline cleaners)	**Accepted**	**O**
44. Landing characteristics	**Accepted**	**O**

OPTIONAL ITEM CHECKLIST

Pitot Cover	**Accepted**	**O**
Tie down straps	**Accepted**	**O**
ELT Serial #_____	**Accepted**	**O**
Cockpit cover	**Accepted**	**O**
Fuel Tank	**Accepted**	**O**
Master Keys	**Accepted**	**O**
Portable antenna ELT	**Accepted**	**O**
Manuals, POH, Maint. Manual, Kit Assembly & Parts Manual	**Accepted**	**O**
Bailey Release and Tow System if Equipped (Optional Equipment)	**Accepted**	**O**

Owner/Operator Responsibilities (required by FAA & Consensus Standard ASTM F2245-10c)

1) Each owner/operator of a LSA shall read and comply with the maintenance and continued airworthiness information and instructions provided by the manufacturer.

2) Each owner/operator of a LSA shall be responsible for providing the manufacturer with current contact information where the manufacturer may send the owner/operator supplemental notification bulletins.

3) The owner/operator of a LSA shall be responsible for notifying the manufacturer of any safety of flight issue or significant service difficulty upon discovery.

4) The owner/operator of a LSA shall be responsible for complying with all manufacturer issued notices of corrective action and for complying with all applicable aviation authority regulations in regard to maintaining the airworthiness of the LSA.

5) An owner of a LSA shall ensure that any needed corrective action be completed as specified in a notice, or by the next scheduled annual inspection.

6) Should an owner/operator not comply with any mandatory service requirement, the LSA shall be considered not in compliance with applicable ASTM standards and may be subject to regulatory action by the presiding aviation authority.

Customer Name printed_____

Customer Signature _____ Date _____

Sales Person Name printed _____

Sales Person Signature _____ Date _____

For Production Office get the following items:

Copy of Acceptance for QA documents
Copy of W&B in POH
Copies of Assembly Documents
Copy of FAA Documents,

a) **Registration App.,**
b) **Airworthiness,**
c) **Statement of Compliance,**
d) **Operating Limits, etc…..**

Serial Numbers Aircraft S/N _____

Engine S/N _____ Gearbox S/N _____

Propeller S/N _____

ELT S/N _____ Model _____

I certify that the appropriate documents have been copied and entered into the Compliance Manual under the Serial Number of this aircraft!

Sales Person Name printed _____

Sales Person Signature _____ Date _____

Safety of Flight & Service Difficulty Report Form

Mail to: Pitman Air, 1840 Airport Blvd., Red Bluff, CA 96080 or Online at: www.pitmanair.com/dragonfly/

Check One	Item of Concern	Safety of Flight	Service Difficulty

Reporting Party Contact Information

Name	
Address	
City	
ST	
Zip Code	
Day Phone #	
FAX #	
email address	

Check Appropriate

Owner	Operator	LSRI	LSRM	A&P
Other Explain:				

Aircraft Specific Information

Aircraft Information		Engine Information	
Make		Make	
Model		Model	
Serial Number		Serial Number	
N-Number		Gearbox Ratio	
Date of Mfg.		Propeller Mfg	
		Propeller Serial #	

Date of Problem Discovery _____ dd/mm/yyyy

Description:

Use Attachments and Photo's if Needed

Comments _____

Signature_____-Date_____dd/mm/yyyy

Safety of Flight & Service Difficulty Report Form

Mail to: Pitman Air, 1840 Airport Blvd., Red Bluff, CA 96080 or Online at: www.pitmanair.com/dragonfly/

Check One	Item of Concern	Safety of Flight	Service Difficulty

Reporting Party Contact Information

Name	
Address	
City	
ST	
Zip Code	
Day Phone #	
FAX #	
email address	

Check Appropriate

Owner	Operator	LSRI	LSRM	A&P
Other Explain:				

Aircraft Specific Information

Aircraft Information		Engine Information	
Make		Make	
Model		Model	
Serial Number		Serial Number	
N-Number		Gearbox Ratio	
Date of Mfg.		Propeller Mfg	
		Propeller Serial #	

Date of Problem Discovery _____ dd/mm/yyyy

Description:

Use Attachments and Photo's if Needed

Comments _____

Signature_____-Date_____dd/mm/yyyy End